MAY 1963

UNITED STATES ARMY AVIATION DIGEST

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CONTENTS

LETTERS 1
NO MAGIC FORMULAS, Gerard Bruggink 3
GUARD TALKS PREVENTION 10
WE SUPPORT, Capt Arthur E. Dewey 12
A PAGE IN HISTORY, Maj Milton P. Cherne 16
AVIATION SAFETY, Capt Joseph C. Boggs 19
A SMALL UNIT INSTRUMENT TRAINING PROGRAM, Maj Edwin O. Carr 23
TWX 26
UH-1Bs REACH THE SOUTH POLE, Scot MacDonald, JOC, USN 28
START YOUR FLIGHT RIGHT! 29
MAN TO MAN 30
WHO'S GOT A SECRET? 31
FLYING AND T-BUMPERS, William H. Smith 34
SPARK PLUG FOULING, Lt William J. Hodnett 40
SS-11 WEAPON SYSTEM 43
CRASH SENSE 45
START YOUR FLIGHT RIGHT! ..... Inside Back

Cover: South Vietnamese troops board a U. S. Army CH-21 helicopter to embark on a mission against Viet Cong forces in South Vietnam. It took 18 seconds to load and 12 to unload each aircraft.

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U. S. Army Aviation Digest, Fort Rucker, Alabama.*

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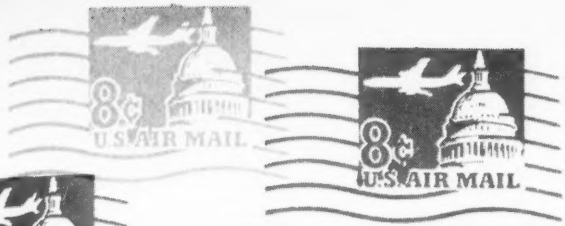


LETTERS

Sir:

We here at Fort Riley read the two articles concerning helicopter formation flying in the February issue with personal interest. The accompanying article to the one by CWO Wilcoxen, written by Dr. Prophet, was of especial interest. Of course, we had no idea that this idea was of so much scientific interest, but I feel that some explanation of how we did this may be helpful. I, for one, would definitely like to see more research on the problem of crew duties in Army Aviation.

First, let me say, this idea was not handled quite as haphazardly as Mr. Wilcoxen may have indicated. We left out some of the background on the article (in fact, I'll take the blame for the blue pencilling) in order to shorten the article. I see now that this was a mistake.

Second, when the idea was first proposed by Mr. Wilcoxen, many aviators did just as the Doctor said, and poohpoohed it.

Third, the entire idea was analyzed with flight safety in mind. This idea was discussed in the early stages with the flight surgeon, and the aviation safety officers of the airfield and the unit (both of whom are graduates of the USC safety course). Their ideas were incorporated into our final expression.

I chaired the discussions that followed, as I was the section commander, and the seventeen aviators involved were extremely free with ideas during the discussions. We used the following method to arrive at our final solution before we ever tried it:

a. When did most critical time occur?

b. Who was doing what at this time?

c. What was actually happening at this time that was causing difficulties?

d. What had to be done to correct c, above?

e. How could it be done?

f. Who could do it?

g. Who would do it?

I'm not at all sure of the science involved in this, for while we'd all been to college, probably Psych one or two is all we had. But this went on for some thirty days, off-duty in people's homes, and of course, in the Cockpit Club that all aviators know at Marshall Field. I'm sure we did not consider "feedback," and I'm certain we'd like to know more about what that is.

I think, though, that the final result of those finely trained aviators, cooperating with each other, benefitted the entire effort here at Ft. Riley. We standardized every aviator involved to the point where any two could get into the cockpit, and fly the mission with no problems, often without even communicating with each other. Pressures on the controls told the story. One aviator followed through on control pressures, even though one watched the ground and one watched the aircraft in the formation. Any really serious pressure took control as long as the pressure was maintained. After I flew the system many times myself, I realized that the actual control passed rapidly back and forth from one side of the cockpit to the other on each landing.

I hope that Doctor Prophet can work on this system and refine it for universal use. It is really needed today in the field, if we are to get in and out quickly and still retain our basic formations.

CHARLES H. DRUMMOND, Jr.
Major, Artillery
Hq Prov Avn Bn
Fort Riley, Kansas

Sir:

I was very interested in the article on autorotations, "Yes or No," in your December issue.

The argument against autorotations appears to contain at least one very large hole. No mention is made of how much more expensive the accidents would have been, both in life and hardware, if autorotations had not been practised previously.

The opening quotation "lifted" from Col Neel seems singularly inappropriate. Surely the point is that having received some measure of instruction in touchdown autorotations the unfortunate "non-swimmer" has at least been introduced to the water.

Probably the greatest fear of all is the fear of the unknown.

It is noticeable, during autorotations, the psychological change that comes over a pilot when his mental approach changes from "I think I can" to "I KNOW I can." This psychological change is manifest in a marked improvement in airmanship from entry to touchdown. The apprehension which fogged his mind in the initial stages of the exercise has been replaced by an ability to concentrate on each stage of the manoeuvre resulting in all round improvement in morale.

Of course it may be argued that the circumstances and terrain will determine the outcome of the landing. This, however, is no excuse for doing nothing.

It is unrealistic to imply that the presence of the I.P. was unnecessary in many instances. The exposure rate of the I.P. is very high and it is probably true to say that the initial instructional periods are the most hazardous.

The ground *is* removed from the manoeuvre during part of the autorotation instructional sequence by employing the power recovery technique during a number of lessons. Unfortunately the fear of the unknown touchdown remains.

The solo autorotation to touchdown, properly supervised, is a vital part of the training of any Army helicopter pilot.

After all, has anyone ever suggested that we should stop making glide landings in light fixed wing aircraft?

JAMES CULLENS
Major, Army Air Corps
British Exchange Officer
Canadian Joint Air Training Centre

Sir:

Lt Col Cantlebary's article [January 1963], A COMMAND PERFORMANCE, really hits the spot! The whole problem of safety can only be resolved when commanders assume their share of the task in promoting aviation safety.

This article supports my arguments when I have vehemently disagreed with those who claimed "They're rated aviators" or "He's checked-out in the aircraft" and that the commander's responsibility rested there. Just as long as his aviators are flying, he must be sure that the pilot can cope with the conditions he may encounter on that flight on that day.

Furthermore, as Col Cantlebary says, an SOP alone will not make a program work. The SOP must be realistic and must be utilized, particularly by the C.O. who sets the theme. The commander can only make his people aware of safety by being safety conscious himself.

A. R. ZENZ
Capt, CE

Sir:

While reading the letter from Captain Le Blanc, published in the February 1963 issue, I became quite concerned; not with the intent or philosophy that he is attempting to impart, but with the misconceptions his statements might lead to. . . .

Captain Le Blanc stated the -20P and the -34P for the U-6A do list both FSN 6610-557-3407 and FSN 6610-557-3408 as Indicator, Attitude, in the indices (both part number and FSN). However, it would have been better had he gone on and stated that, in the breakdown, Section II, Sub-section 0300.15, these two items are listed with correct nomenclature and acceptable interchangeables for each.

I take exception to the statement in Captain Le Blanc's second paragraph: "The U-1A -20P and -34P contain the same mistake in both the numerical index and the systems breakdown." I am convinced that the Captain was referring to publications which have since been republished, as the current -20P and -34P for the U-1A, September 1962, are correct in all areas regarding the two indicators.

Further, it is very possible that the submission of the URs to this headquarters by Captain Le Blanc's unit, regarding the discrepancies, could have been instrumental in correcting the latest publications. However, I would like to point out that the proper form to use when advising this headquarters of noted discrepancies in supply-type publications is the DA Form 2028.

Now, let's get into the area of "interchangeable versus substitute" and "SACs 19, 31 and 32" items. There is a distinct difference between an interchangeable item and a substitute item, in that the interchangeable items possess such technical and physical characteristics as to be freely exchanged one for another, irrespective of application and performance. These are replaceable-type items whose internal components, repair parts, etc., are not completely 100% interchangeable. They are usually AERNO, AN, MS, etc., type items. Substitute items, on the other hand, are items which have been superseded by an improved version of an item currently in use in a given application. Use of the substitute item is usually continued until existing stock is consumed or exhausted.

In view of the above definitions, the first sentence of paragraph 4 of Captain Le Blanc's article: "For each type instrument we find in Army Aviation, there are a multitude of substitutes; however, only one of these interchangeables is coded with a SAC of 32," is very misleading and adds to the existing confusion in the use of the two terms. SAC 32 is used to identify the "master item number." This is a reference and/or procurement number only for items functionally interchangeable (code 07) such as AERNOs, ANs, MSs, procurement reference numbers, etc. This code (32) [SM 55-135-1-32, dated 2 July 1962] is applied to the master accessory item for grouping interchangeables, requirements computations and levels of *items manufactured by two or more manufacturers.*

Substitute items, code 04 (as defined above) are related to SACs 19 or 31. As further clarification, the following is submitted for the edification of all:

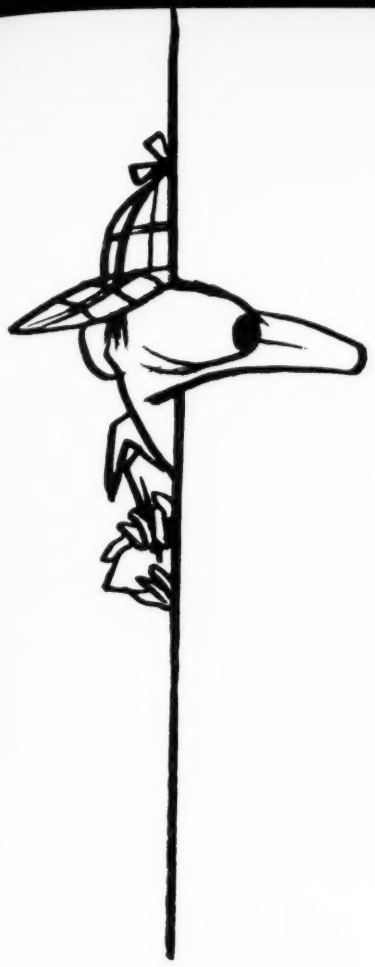
a. SAC 19. *Stock Item.* This item is carried in depot stock and/or is on procurement for depot stockage. Items with substitute item code (04) indicate *one-way* substitutability.

b. SAC 31. *Preferred Item.* This item is a superseding item for one or more other items with SAC 04. It is issued only after the stock of 04 items is exhausted. This item has complete (two-way) substitutability with its code 04 item(s).

Captain Le Blanc further states that "if the instrument face is appreciably different, and you have a group of Army Aviators who confuse as easily as Poor Ol' Joe, carry a writeup (red diagonal) on the DA Form 2408-13 or DA Form 2408-14 until the instrument is replaced with one that Joe understands." This is incorrect in accordance with paragraph 57c(4) of TM 38-750 as long as the instrument is performing its prescribed function. The only thing to do in a case of this nature is for the pilot to become familiar with the new type face prior to takeoff.

This letter is not written to criticize the writings of Captain Raoul J. Le Blanc, Jr.; in fact, he is to be commended for taking the time and effort to prepare his letter. What he wrote has generated thought and action and is, therefore, beneficial to the Department of the Army as a whole. More people, like Captain Le Blanc, should air their findings and opinions rather than keep them to themselves where no one can discover or take corrective action, when necessary, regarding them.

GLENN H. DZOMBAR
Technical Assistance Officer
Headquarters, USATMC



Where do you look for clues?

No Magic Formulas

Gerard Bruggink

EVER SINCE it became possible to make a living in the accident investigation and prevention field, the complexity of the investigating and reporting procedures has grown with the pay scales of the safety experts. So much is required now from the man in the field that the essentials of the investigation often are lost in a flurry of paper. As part of our overall effort to increase Army Aviation's mission capability through improved accident research, I will try to put the What, Why, and How of accident investigation in their proper perspectives, without resorting to magic formulas.

WHAT IS AN ACCIDENT?

We could spend several hours discussing the validity of all the definitions that have been developed, starting with the one that calls an accident an unplanned event, but it serves no useful purpose. From the practical point of view, an accident is adequately defined as a *manifestation of failure*. Of course, there are exceptions in the form of so-called acts of God, but these are adequately covered in "Twilight Zone." Our concern is with the typical, everyday Army aviation accident, which invariably can be traced back to failure on the part of designer, builder, operator, or supporting personnel.

Accidents are a waste, but not completely so, unless we ignore the basic reasons for the underlying failure. Aircraft accidents are as old as aviation and, paradoxically enough, have played a critical role in the rapid progress of aviation, because their investigation and analysis stimulate the search for perfection. There is no need to prove that thorough accident investigation plays just as critical a role in the mission capability and mission accomplishment of Army Aviation.

HOW TO ORGANIZE AN ACCIDENT INVESTIGATION?

You receive an excited telephone call informing you that one of your pilots clobbered an OH-23. What do you do now?

If you have followed the instructions in DA Pamphlet 95-5, there is not a thing you have to do right now, because the two most immediate problems—the crash rescue of survivors and the preservation of wreckage—were solved ages ago in your unit's preaccident plan. While this plan takes effect, don't

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Mr. Bruggink is an air safety investigator with the Investigation Division of USABAAR.

waste time and energy with remarks as: "There goes our safety record," or "It was just a matter of time with him." An accident, especially a bad one, can be a very unsettling event, but as a man in a responsible position, you should know the importance of keeping your emotions and opinions under your hat.

After the dust has settled and you have had the opportunity to establish the basic accident facts, you send a crash facts message as spelled out in AR 385-40. Don't feel obliged to *speculate on the cause* of the accident in this message. All that is required of you is a brief description of how the accident occurred. It is easier to send a supplementary message than to have to retract an untimely statement.

In many cases, valuable evidence at the scene of the accident is lost or destroyed already before the crash facts message hits the wires. Typical examples:

Rescue, firefighting, and sightseeing vehicles obliterated ground marks.

Overzealous firefighters drained fuel tanks before samples were taken.

Scattered parts collected by order-loving persons or guard personnel.

Photographers arrived late at the scene or economized on film.

Failure to obtain statements (or addresses) from witnesses before they left the scene of the accident.

Accident board members began to tinker with the wreckage on their own initiative, and before the investigation was organized.

Before becoming involved in details, let's ask ourselves: "What exactly is meant by the organization of an investigation and when does it start?"

Only one part of this question has a straight answer: *the investigation starts as soon as you become aware of the accident.* My answer to the question of organization of the investigation sounds like a misplaced joke. Nevertheless, here it is: you cannot organize an investigation in the business sense of the word; you can only *orient the investigative efforts.* If I am disappointing you with this statement it is only because textbooks have given you the wrong impression. When you read examples used for illustrative purposes, you are aware only of the purposeful actions, all leading to the gift-wrapped solution at the end. This gives you the idea that the whole thing was prearranged or preorganized while, actually, the organizational aspects of the investigation become apparent with hindsight only.

There is a strong parallel here with the hindsight of historians who, overnight, make a brilliant strategist out of a general who was only adjusting himself to the conditions as they changed. If you want to see organization in an investigation, you must look at the orientation of all investigative *efforts.* In many cases, you don't even know what you are looking for until you find it. It is like having an octopus by the tail, but you don't know which tail it is. You have to keep chopping at them until all mystery is gone.

It is only during the initial phase of the investigation that a more or less standard set of routines can be applied, such as:

—the collection of all data and documents having a bearing on the aircraft, the pilot, the flight plan, the weather, and all related factors;

—obtaining statements from crew members, passengers, witnesses, and other personnel which may be involved;

—a preliminary survey of the scene of the accidents (wreckage diagram and debris pattern).

Information gained from these initial procedures provides

"Play it by ear"

Who's in charge here?

the board with a picture of the pertinent circumstances surrounding the accident and will, in most cases, govern the next step in the conduct of the investigation. From this point on, you are involved in the actual investigation and there are no rules to lean on. You have to play it by ear. If you are lucky enough to find one or more specific clues in the initial data, you follow them up. If there are no clues, you may have to use the negative approach; that is, the systematic elimination of all factors that could *not* have contributed to the accident.

When properly tackled, this task is not as hopeless as it sounds. Your main concern should be to have a definite but flexible plan of attack and then to see to it that the right job is done by the right man. Basically, the investigation of an accident is nothing but the application of common sense and available knowledge to a problem which is bewildering only when we try to solve it without defining it. In other words, organized, methodical thinking is more important than organizational talent per se. (NOTE: Every board member should be familiar with the general principles of accident investigation, as explained in DA Pamphlet 95-5, *before* an accident occurs. Further guidance can be found in the excellent ICAO publication: MANUAL OF AIRCRAFT ACCIDENT INVESTIGATION, Doc 6920-AN/855/3.)

When confronted with a serious accident, your first impulse may be to call everybody but your mother-in-law for assistance. This is natural, but remember that too many helpers can be just as harmful as not having enough. First, use the available resources in your own command; find out what their capabilities are and exploit them without exceeding them. Too often, evidence is lost because unqualified personnel tamper with complex equipment which can be tested only by higher echelons or by the manufacturer. (Not long ago I saw a well-meaning flight surgeon disassemble a defective inertia reel with a pocket knife, while he was sitting in the grass near the accident site!)

AR 385-40 gives you the privilege to request special assistance *when your own manpower resources are inadequate*. Remember, however, that regardless of the number of specialists involved, *you* are conducting the overall investigative effort and you are responsible for the final report.

WHAT TO INVESTIGATE?

Probably more important than knowing *how* to investigate is knowing *what* to investigate. This is another area where textbooks are of little help, because they provide only generalized guidelines. A school-trained investigator without field experience may try to make the accident conform to his checklist and wear everybody out in the process. He may end up with a board more interested in hanging than supporting him. A more popular, but just as harmful, type is the investigator who tries to make the evidence fit his pet theory. Beware of him, especially when he is a slick talker. You may end up with a quick and good looking accident report, but if you have a no-nonsense CO, he will shoot it full of holes at first sight.

The two types of investigators just described present two extremes: one investigates too much (lack of judgment), the other not enough (misjudgment). One is overeager, the other is prejudiced. Somewhere in between stands the cool cat we are looking for—the man who organizes and directs the investigative efforts of the board without regard for the consequences, *guided solely by professional integrity and the evidence as it develops.* This man realizes that evidence, even in the form of a hint or a suspicion provided by the initial data, is in a constant state of flux. However, he never has a problem deciding *what* to investigate because to him it is simply a matter of applying the prove-or-dis-

prove-it method to every possible cause factor suggested by the evidence *as it becomes available.*

Instead of drooling over an ideal investigator, let us review some practical don'ts.

Don't ever jump to conclusions; don't even venture a suggestion as to a probable cause unless you have investigated *all* possibilities.

Don't take anything for granted; every statement you make must be verifiable.

Don't expect that every accident investigation will result in earth-shaking revelations.

Don't rely on persons who believe that accident investigation is purely a white-collar job.

Don't let the deadline for the report rush you into premature conclusions.

Don't move the wreckage to a more secure area unless you are sure that no relevant evidence will be lost in the process.

Don't release the wreckage for salvage until the investigation is closed.

Don't underestimate the available services of your flight surgeon or medical officer. In most cases they are the only personnel qualified to look into the human factors aspects of the accident.

THE ACCIDENT REPORT

The accident report is the culmination of all investigative efforts. It explains what happened, how it happened, why it happened, and what can be done to eliminate all related and unrelated cause factors. Unfortunately, it is in this critical area of the accident board's responsibility that most of the errors—not to say blunders—are made.

Complying with the clear-cut requirements in AR 385-40 and completing the routine parts of the Army aircraft accident form (DA Form 2397) is no problem. It is only when the wide open spaces of section N (Description of the Accident) and section O (Findings and Recommendations) have to be filled with rational language that we become helpless at times. Don't feel too guilty about this. The instructions you have to work with leave something to be desired, and if you have no experience in this field, they can easily lead you astray.

The instructions for section N read: "Use this section to make a brief narrative of the accident. A detailed description will also be made and placed in the accident report as an attachment." What is meant here? DA Pamphlet 95-5 (chapter 4) provides the answer.

Section N of the accident form should contain a *brief* narrative of the accident, including what happened, *but omitting details.* The *detailed* narrative referred to in the instructions is a self-contained history of the accident and the investigation, written in a manner that will tell the reader the sequence of events leading to, during, and following the accident. It should be chronologically clear, well supported with evidence, and should leave no doubt in the reader's mind about the completeness and thoroughness of the investigation.

The detailed narrative, attached to the report as a continuation of section N, is the heart of the report. The suggested outline to write this narrative, given on pages 30 and 31 of DA Pamphlet 95-5, is the best insurance against inadequate reporting, because it forces you to evaluate the effectiveness and logic of your efforts to determine the cause factors. As was said before, it is only at this time that any form of organization or logic in your investigation becomes evident, in retrospect, in your description of the accident and investigative procedures.

Finally, our greatest bottleneck: Findings and Recommendations (section O). The instructions read: "List all factors which contributed toward the accident. List all recommendations which will serve to prevent recurrence of this type accident."

In many cases, a thorough investigation will reveal deficiencies which have no bearing on the cause of the accident. It would be unfair to the personnel involved to list them as factors contributing to the accident. On the other hand, by not mentioning them, you may deprive your CO and probably other units from the chance to improve the quality of their operations. To avoid this oversight in the instructions, I suggest that you list your findings as "contributing factors" and "unrelated factors."

This distinction is not needed for the recommendations. In addition to what the instructions say, it is my opinion that recommendations should go beyond the limited objective of "preventing recurrence of this type accident." Accident investigation should primarily be seen as one of the quality control tools in the improvement of Army Aviation's mission capability. By revealing failures and the source of failures, we not only provide the means for the prevention of one particular type accident but, more significantly, we provide the means for overall system improvement. It would be a sad day indeed when our concern about failures was motivated only by their accident potential. As the old saying goes: Safety is the by-product of doing something the right way.

Your findings and recommendations can be brief and to the point, because all the explaining is done in the detailed narrative. Some more don'ts:

Don't mention names in connection with cause factors; it is sufficient to mention an individual's function.

Don't list cause factors which are not analyzed in the narrative.

Don't refrain from mentioning a cause factor because somebody may not like to see it printed.

Don't look at cause factors as a blame distribution system.

Don't use the description of an event in the accident sequence as a cause factor.

Don't hesitate to admit defeat when no cause factors can be established. When you can offer theories only, make this clear, and be sure to substantiate them in your narrative.

When you have properly defined the cause factors, you should have no difficulty coming up with pertinent recommendations. Don't try to fix all of Army Aviation's problems once and for all. Stick to the problems revealed by your investigation and you will have a more attentive audience. Leave out all generalities such as, "Commanders should assure that all pilots attend the safety meetings." Unless the pilot in the subject accident missed a vital piece of information by not attending one particular safety meeting, you are confusing the issue.

CASE HISTORIES

There is probably no better way to impress you with the fact that the quality of your investigation reflects your *attitude* toward aviation and aviation safety than the analysis of a few accident reports as we received them. Without exaggeration, it can be said that accident reports are like personal letters —often they reveal more about the sender's character and standing than is anticipated or desirable!

CASE NO. 1

An OH-23 pilot with 1,850 hours of flying time, with 400 in helicopters, took off for a local weather check. According to the pilot, he encountered lowering ceilings at a distance of 6 miles from his home pad and decided that he could not continue on his course under VFR conditions. As he started to make a 180° turn, he began to lose rotor rpm and altitude. Full throttle was applied but the aircraft continued its descent and was landed on a railroad track. The main rotor struck a tree, resulting in a total damage of $12,500.

According to the accident report, the ceiling at the time of the accident was 75 feet with a visibility of ½ mile. When the pilot noticed that the railroad tracks he was following were entering a tunnel, approximately ½ mile ahead of him, he initiated a 180° turn to the right. During this turn, engine rpm was reduced to 2600 and the aircraft airspeed fell to zero, followed by an uncontrollable descent of the aircraft.

The passenger in the aircraft (a mechanic) had this to say: "As we rounded a curve in the railroad tracks, we came upon a railroad tunnel and the pilot started to turn around. We began to lose altitude and the pilot

was unable to recover."

After reading these three versions of the same event, healthy curiosity immediately raises the following questions:

What approach did the accident board use to investigate this accident?

What is the purpose of checking weather which forces a pilot down on the deck?

Was the drop in rotor rpm pilot-induced, or had it a mechanical origin?

What did the flight surgeon have to say about the pilot's perseverance under the existing weather conditions?

Unfortunately, we will never know the answers to these questions because the accident report lacks the following items:

- A narrative of the board's proceedings and analysis.
- The flight surgeon's analysis.
- A copy of the pertinent official weather report.

All we have to work with are the board's conclusions and recommendations. Only by reading between the lines do we get a vague notion of the true story.

The accident report lists the primary unsafe act as "Loss of rpm and airspeed during 180° turn, resulting in uncontrollable descent." This so-called primary unsafe act is nothing but the description of one event in a chain of events, leading to the accident. With respect to the true cause - and - effect relationship, this conclusion has the same insignificance as the statement that the cause of a groundloop was loss of directional control.

Loss of rpm and airspeed have specific causes. Although an investigation may fail to provide a definite answer, it is the board's responsibility to analyze and evaluate each possible cause. In this particular accident, there is only indirect reference to the cause of the loss of rpm and airspeed, nicely hidden in recommendation No. 1: "All pilots should be briefed on the necessity to maintain rpm and airspeed during turns." The implication of this recommendation, obviously, is that the board considered the loss of rpm and airspeed pilot-induced.

Bent aft wing spar attachment

Since railroad tracks occasionally have the habit of disappearing into the ground, thereby depriving the pilot of a navigational aid, the board also recommended that "Pilots be rebriefed on the danger of following railroad tracks in terrain where tunnels are prevalent."

Finally, since "flying into marginal weather in hilly terrain" was mentioned in the report as a contributing factor, it was recommended that "Pilots be reminded of the danger of flying VFR in IFR conditions." Instead of resorting to this noncommittal generality, the board should have discussed the VFR weather minima in the pilot's unit and the reasons why the applicable rules were inadequate to prevent the pilot's attempt to fly beyond his capability.

Don't let the critical review of this accident report give you the impression that it is the poorest case in our files. The disturbing fact is that as far as quality of investigation and reporting is concerned, this case is only slightly below average. I selected it only because it illustrates so well the problems confronting an accident board charged with the investigation of the intangibles of a typical weather accident.

CASE NO. 2

Let us consider the case of the U-6 pilot who struck a gatepost while taxiing his 48-foot wide aircraft through a 65-foot wide gate at a USAF base, causing $5,300 damage to the left wing.

There is something peculiar about damaging an aircraft on the ground. According to our regulations (AR 385-40), a mishap on the ground resulting in damage becomes an aircraft accident only when there was intent for flight. In this particular case, the pilot happened to be coming in from a landing, and the accident board was in business.

Another interesting fact about taxi accidents is that by definition they are almost the result of operator error. There are exceptions, such as sudden brake

failure or collapsing pavement, but not in this case.

This accident was simply a matter of a pilot taxiing the left wing (on his side) into a 10-foot high gatepost (the top four feet painted orange) in broad daylight. There are no indications that the pilot was concerned about the clearance between the gateposts. He did not wait for assistance, nor did he ask one of his four passengers to guide him. After feeling the first bump, he thought that the tailwheel had struck something and applied power to proceed. The resulting second contact with the post was the most severe.

Before continuing with the board's findings, it should be noted that:

Periodic inspection No. 8 had just been completed on this aircraft and a test flight was required. The test flight was combined with the administrative flight during which the incident occurred.

After a local inspection of the aircraft damage, the cross-country flight was completed without further incident. Before field maintenance grounded the aircraft, *five days after the accident, due to a bent aft wing spar attachment requiring major overhaul of the wing,* the aircraft was used for the following missions: NIGHT FLYING, SHORT FIELD TAKEOFFS AND LANDINGS, AND PARADROPS.

What did the accident board have to say about the accident cause factors? The report lists eight cause factors: the first five are summarized as supervisory error; the last three, pilot error. The first one on the list of the accused must have been as surprised as we were: the Aviation School at Fort Rucker, for "qualifying the pilot in the U-6 after only 4.5 hours of dual VFR instruction and an incomplete checkout in all phases of U-6 operations." (NOTE: The pilot had 65 hours of U-6 time, including 46 hours hood time.) The second one on the list is the unit's aviation and maintenance officer, for allowing the aircraft to be scheduled on a mission before completion of a test flight. The other participants were an ordnance officer who failed to cut the gateposts down to size and the aviation section personnel at the AF base who failed to guide the pilot and painted too short a yellow center line in the gate opening.

In the second section of the cause factors, it is admitted that the pilot was not fully alert and cautious while approaching the parking area. Strangely enough, however, none of the recommendations have a bearing on the pilot's involvement in this accident. They refer only to the alleged shortcomings of supervisory personnel. Needless to say that this analysis caused some clearly-worded "nonconcurs" from reviewing officials.

Actually, the only board member who hit the nail on the head was the flight surgeon. He took the trouble of looking into the human factors aspects of this accident and discovered that the pilot's judgment at the time of the accident had been adversely affected by his unfamiliarity with the Air Force base and the time spent trying to locate the Army area. In the flight surgeon's words, "The pilot was mad because he had been taxiing around lost for 15-20 minutes. Because of the delay in finding the Army parking ramp, he was apprehensive that he would be late taking off. He was not paying as much attention to the gateposts as he should, but was aware of their presence."

What does all this commotion about a straight-forward taxi accident prove besides the nuisance value of our nit-picking ability? Simply this: The real issue in an accident should not be confused with the circumstances surrounding it; the accident board did an excellent job of unearthing contributing factors, but put the wrong emphasis on them; and thorough accident investigation gives the commander the opportunity to discover and remedy organizational deficiencies which may not even be remotely connected with the direct cause of the accident.

CONCLUSIONS

If, after saying my piece, I have left you with the impression that you have heard nothing that you did not know or suspect already, I would be extremely pleased. It would mean that I have managed to discuss the essence of accident investigation and reporting in practical, useful terms. It would mean also that you must be convinced, as we are, that the most important part of the investigation is the investigator himself.

Accidents and accident investigations are not the most pleasant aspects of aviation. However, without the dedication and perseverance of the men who have to delve into them, we would repeat our failures and defeat the purpose of our mission.

Air Safety Meet in Windy City . . .

Guard Talks Prevention

MEETING IN Chicago, the Army National Guard held the first aviation safety conference of its type 12-13 March. Brig Gen Francis S. Greenlief, Assistant Chief, National Guard Bureau, issued invitations to attend through the adjutants general of all 50 states and the Commonwealth of Puerto Rico. Representatives from 49 states responded, despite snow, sleet, rain, and low ceilings which grounded many commercial airliners and forced some of the Guard aviators to complete their travel by train and auto.

Other conferees included personnel from USCONARC, ODCSOPS, USABAAR, USAAVNS, and the FAA. The host officer was Lt Col Frank O. Grey, Jr., Illinois. Serving as moderator was Lt Col George P. Kelly, Chief, Aviation Branch, Operations and Training Division, National Guard Bureau.

USABAAR director, Col Robert M. Hamilton, and four members of his staff delivered the major portion of the conference speaking schedule. Colonel Hamilton stressed the need for improved unit training in both the ARNG and Active Army. "We fully realize that our problems in the Active Army are basically no different from yours. . . ."

". . . Army advisors have the responsibility of flight checking your aviators and recommending them for permanent flying status. Therefore, well-qualified aviators must be selected as advisors. They must have sufficient experience to tell when an aviator is properly transitioned and they must have time to do their job properly.

"National Guard accidents naturally increase during the summer training period due to increased flying and exposure time. I recommend that you stress field operations in every phase of training prior to summer camp.

"We are very happy to see the operations and training position become a reality in the Guard. You O&T people have the ability, authority, opportunity, and responsibility to improve the caliber of aviators through a better education and training program."

Speaking on the subject of standardization, Maj George C. Kuhl said, "Basically, Active Army Aviation is encountering many of the same problems that the National Guard is experiencing. In numerous areas we can draw parallels. Standardization of flight training is one of these problem areas." Major Kuhl recommended that a National Guard standardization board be designated and assigned the responsibility for providing, publishing, and distributing procedures for standardization of all Guard aviation. This would include standardization of aircraft checklists and flight maneuvers. The board would be the final authority in all changes involving standardization and would have the responsibility to designate the most qualified instructor pilots to conduct the Guard flight training program.

Major Kuhl concluded by saying, "There is no place in aviation, whether it be Active Army or Guard, for haphazard, inadequate flight programs governed by obsolete regulations and poorly supervised flying practices."

Present and proposed aircraft inventory figures were presented by Col Robert H. Schulz, ODCSOPS. He pointed out the increased emphasis being placed on aviators to achieve true mobility and stressed the need of preserving trained personnel and aircraft for potential combat efforts.

Mr. Gerard M. Bruggink, USABAAR air safety investigator, whose article "No Magic Formulas" appears on page 3 of this issue, discussed techniques of accident investigation, with

Prepared by the United States Army Board for Aviation Accident Research.

emphasis on an open mind attitude.

The Army training program and directives concerning combat effectiveness tests and evaluations related to ARNG training were discussed by Lt Col William C. Edler, USCONARC.

Charles W. Carmody, Chief, Operations and Evaluation Division of Air Traffic Control, FAA, briefed the gathering on the operation of his organization. Following this, during a 15-minute question-and-answer session he offered practical solutions to communications problems facing Guard units.

Other speakers representing USABAAR and the Army Aviation School were Mr. James E. Coleman and Captain Ronald C. Vines.

An indication of the success of the conference was reflected in the closing remarks of General Greenlief, who cited three important areas where ARNG could derive benefits from the conference: *standardization, supervision,* and *field training operations.* In discussing supervision, he included command responsibility and the importance of educating nonflying commanders to the peculiar needs of aviation.

Colonel Hamilton called the conference, "One of the finest I ever attended. The atmosphere was open and frank, and enthusiasm was high. People sat down and took a hard look at their problems and discussed them candidly. This is essential to a successful safety meeting. I am sure the conference will be of lasting benefit."

Three Aviation Courses Offered by USAFI

THE UNITED States Armed Forces Institute (USAFI) is offering three correspondence courses in aviation that are of value to personnel intending to follow an aviation career.

The courses—General Aeronautics, Aircraft Engines, and Jet Aircraft Engines—are available to all military personnel on active duty who have at least 120 days of obligated service. (Also eligible are cadets at the four service academies.)

• *General Aeronautics* is available as a 12-lesson introductory correspondence course in basic principles and mechanics of aircraft operation and construction.

Topics covered include the history of flight and aircraft; forces of motion; forces acting on the aircraft; control of aircraft in flight; stability, design, and construction of aircraft components; powerplants; instruments; propellers, fundamentals of flight; meteorology and navigation; and aviation terminology.

The prerequisite for this class is a course in high school physics.

• *Aircraft Engines* is available as a 22-lesson correspondence course covering procedures for operation, inspection, maintenance, repair and overhaul of the reciprocating aircraft engine.

Topics covered include, internal-combustion engine principles; float-type carburetors; pressure-injection carburetors; superchargers; fuel and fuel systems; valve and ignition timing; starting systems; engine control systems; propeller fundamentals; maintenance and repair; principles of jet propulsion and jet engines.

Prerequisites are courses in high school mathematics and physics.

• *Jet Aircraft Engines* is available as a 16-week correspondence course covering theory, construction, operation and maintenance of jet aircraft engines.

Topics covered include history and theory of jet propulsion; the aviation gas turbine; rockets, ramjets and pulsejets; fuels and fuel systems; lubricants and lubricating systems; inlets; exhaust systems; and thrust augmentation.

Prerequisites are courses in high school mathematics and physics.

Personnel interested in taking one of these courses must fill out DD Form 305. If this is an original enrollment with USAFI, a $5.00 postal money order or a certified check payable to the Treasurer of the United States (USAFI) must be included. (Additional courses are free if the original enrollment is successfully completed.)

Enrollment forms must be submitted to local education centers. If such a center is not available, the applicant should submit his forms to his commanding officer, who will forward them to the appropriate USAFI office.

"We Support," motto of the 1st Aviation Company in Southeast Asia, has more than ordinary connotations. It is no vague idle boast, but a necessary way of life to many units in Vietnam.

We Support

Captain Arthur E. Dewey

THE ARMY'S 1st Aviation Company is now a permanent part of the scene in the Republic of Vietnam. The company is now operating out of its base at Cap St Jacques, 40 miles southeast of Saigon. Twelve of its sixteen Caribou aircraft fly from Vung Tau Airfield at the Cap in support of III and IV Vietnamese Corps while the rest are supporting I and II Corps in the north.

The 1st Aviation Company arrived in Southeast Asia in June 1962, after a historic 11,000 mile flight from Fort Benning, Ga. This marked the first time an Army Aviation unit had flown its organic aircraft to an overseas destination [outside the North American continent].

The company became a part of the SEATO commitment to Thailand and flew in support of Joint Task Force 116. It was assigned to the 9th Logistical Command, which had arrived from Okinawa during this time of instability, and established its base at Korat, approximately 100 miles northeast of Bangkok.

The company supported the first major tactical unit assigned to JTF 116, the 1st Battle Group, 27th Infantry (Wolfhounds), in weekly rotation of its rifle companies to positions near the Laotian border. The Caribou also provided ration and equipment airlift to these companies. This undeveloped portion of Thailand's northeast is accessible only by air during much of the monsoon season.

The Wolfhound's replacement, 1st Battle Group, 35th Infantry (Cacti), ranged even farther into Thailand's hinterland and presented correspondingly greater requirements for airlift and aerial resupply. The battle group's biggest training exercise was in the remote northwest near Chiang Mai.

Loading jeep and trailer into CV-2B at Korat, Thailand

Capt Dewey is a Corps of Engineer officer with the 1st Aviation Company in the Republic of Vietnam.

Most tourists to Thailand read about Chiang Mai with its teak forests, elephants, and wood craftsmen, but few make the 3-hour flight from Bangkok to see it. Fewer still penetrate the jungle curtain surrounding the city. Hence these modern military explorers had only scant information and unreliable maps with which to start their jungle forays in this region.

The Caribou provided valuable terrain intelligence on reconnaissance flights with the battle group staff and company commanders. They flew the tactical troops and their equipment to Chiang Mai, kept them resupplied and evacuated medical patients and defective equipment back to Korat. This was accomplished on a daily basis, in spite of heavy monsoon rains and low ceilings which added to the hazards of flying in the rugged terrain. The Caribou pilots also rendezvoused with the Cacti companies at a small airstrip near the Burmese border and returned them with their native guides back to Chiang Mai when their jungle march was over.

Meanwhile, monsoon rains in the northeast created problems for units of the 4th Cavalry, who were on a 40-day, 800-mile road reconnaissance, testing armor trafficability. These troops were isolated for some time and the CV-2s became their principal contact with the outside world.

The company could expect a variety of mission requests during a typical day's operation in Thailand. These might include flights for counterinsurgency training cadres, rushing serum to a snakebite victim, carrying R&R troops to Bangkok or selected personnel on orientation trips to the Republic of Vietnam. VIP flights were also frequent.

Aircraft at Korat, Thailand

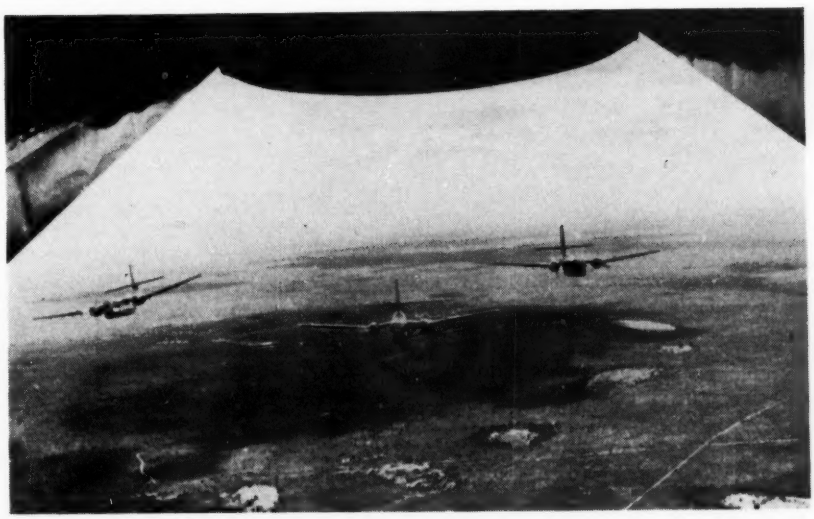
During typhoon Harriet when wind and water created so much damage in southern Thailand, the Caribou crews flew relief to the victims in the form of food and medical supplies, together with engineer teams and their equipment.

A glimpse of the company's camp at Korat would reveal their close identification with the ground soldier. The tents in which they lived, together with their operations and maintenance areas, were located beside the runway. With the assistance of the company's three Engineer officers, and some "Peace Corps" type engineering, the men built their own mess hall, troop billets, day room, and operations building. They literally carved their camp out of the jungle, rid it of snakes and underbrush, and made it home for 39 officers and 124 enlisted men.

The Thailand chapter of the company's operations closed with the phasing out of the U.S. tactical troops and the dissolution of JTF 116. In December 1962, the company received orders for deployment to the Republic of Vietnam.

Eight Caribou crews had already been assigned in the Republic of Vietnam on a monthly temporary duty basis; hence, the pilots and crewchiefs were quite familiar with operations in their new location. The crews continued their normal operations without a break while the rest of the company made the move from Thailand. The company was assigned to the United States Army Support Group, Vietnam (ASGV) and became operational on 1 January 1963. Its mission is to provide immediate and highly flexible aircraft

CV-2Bs in formation; looking out ramp door of lead aircraft



support in furtherance of the MAAG mission in the Republic of Vietnam.

The record so far in Vietnam has already furnished impressive evidence of the Caribou company's unique ability to provide flexible support for the ground soldier whenever and wherever he needs it. The key to this kind of support is in the company's close identification with the ground soldier. This includes the ability to adjust to his often unforeseeable schedules of troop movement, resupply and evacuation. Vietnam has provided significant challenges to the 1st Aviation Company in this flexible response role.

Loading rice for air drop to Vietnamese troops

Logistics support in the Republic of Vietnam's Mekong delta and Ca Mau peninsula hinges largely on the use of expedient airstrips in various stages of development. Most of the strips are short and narrow; many are little islands in the rice paddies with no overruns. Most are plagued with difficult crosswinds during much of the year. Yet, the Caribou pilots use these strips every day, both on scheduled "milk runs" and on special missions.

The terrain typical of the central and northern Vietnamese highlands allows even less margin for error. Particularly in the mountains of the Da Nang area, low clouds, turbulence, and unpredictable downdrafts add to the difficulties inherent in the use of small drop zones and short unimproved airstrips.

Coupled with these demands on the aircraft and its crew is the not uncommon possibility of receiving Viet Cong ground fire. Both in the southern rice fields and in the northern jungles, the line of security becomes extremely vague off the limits of the airstrip or drop zone and the outpost it serves. Consequently, Caribou have occasionally been hit—on climbout from the rice drops, on final approach to airland cargo, on medical evacuations during combat operations, and on leaflet drops over unsecure areas.

In spite of these difficulties, the Caribou crews have been able to conduct their flights on a regular and dependable basis. Special Forces personnel at Mang Buk (30 minutes south of Da Nang) have come to rely on

Unloading rice and livestock at A Loui outpost, Vietnam.

Vietnamese piloted AD-6 flying escort with CV-2B on a mission over VC infested territory in the Vietnamese highlands

the Caribou crews to drop the rice, thatch, and equipment they need for their new compound. The Vietnamese soldier at A Loui outpost (west of Da Nang), cut off from the outside world except for an adjoining 1,200-foot runway, knows that whenever humanly possible, the Caribou crews will fly in the pigs, ducks and rice he must have for survival.

Last Christmas Eve was a good example. For nine days low clouds and monsoon rains had blanketed the A Loui valley. Rations in the outpost were exhausted, and the troops were eating a chop suey made of grass. Then at approximately 1600 hours on 24 December, the weather broke for about three hours. The Caribou crew at Da Nang had waited for days for this opportunity, and they were ready when it came. Within minutes they were airborne. Thirty minutes later they had crossed the trackless jungle to the A Loui valley and descended through the sudden break in the cloud cover to the tiny strip. Scores of hungry troops were standing by and unloaded the squealing, cackling cargo in time for the aircraft to take off before the clouds spilled into the valley again. Through the dust below, the pilots could see the campfires lit and the troops preparing an unexpected pork, duck and rice feast for Christmas Eve.

The Caribou's reputation for reliability and flexibility has spread throughout the Republic of Vietnam. This is the airplane that Vietnamese commanders and American advisers depend on when they need a tough job done quickly. A Vietnamese officer who suddenly faced the requirement of moving his battalion to a beseiged outpost before nightfall can testify to this. So can an American adviser who could find no other way to remove wounded men from a remote, unlighted airstrip at night. So can American missionaries whose families critically needed medical attention, and who could find no other way to get them to a hospital.

CV-2Bs used to relocate Montagnard tribesmen in Vietnam

The Caribou performed these missions because it was built to handle the difficult and unpredictable. Yet, operations here remind one constantly that its mechanical ability is inextricably linked to human appreciation of its capabilities and their willingness to exploit them. This willingness on the part of the officers and men of the 1st Aviation Company has created the flexible man-machine team which has come to assume such an important role in the Republic of Vietnam's counterinsurgency war.

Caribou pilots with the Vietnamese commander at A Loui outpost

Your outfit is part of a STRAC unit . . . a practice alert is called . . . you leave for an "unknown destination." This happened to the first Army cargo helicopter unit to fly in South Vietnam. Would your outfit be ready for such an emergency?

A Page in History

Major Milton P. Cherne

APRIL OF 1961 found the world in a turmoil and Southeast Asia floundering in internal dispute. All eyes followed the news reports closely and speculation of American assistance was a common topic. This month proved to be a triple barreled month for the 57th Transportation Company (Lt Hel), Fort Lewis, Wash. On 1 April 1961 the 57th was selected as a superior STRAC unit. Several days later a typical practice alert was called and the unit started to prepare for movement.

Plans were pulled from the files, boxes were taken out of storage, packing and crating began on a 24-hour basis. Shot records, wills, powers of attorney were reviewed; clothing was inspected; doublechecks were made on aircraft and vehicle maintenance, replacement of short time component parts, and the multitude of other items that must be checked and doublechecked when you are about ready to move. All loading was accomplished in the prescribed time frame. Then waiting for the "word" began. One day, two days, a week—then came the word to unload and prepare for immediate movement to Yakima, Wash., to support the STRAC 4th Infantry through their yearly maneuver. Carefully, each item was unpacked and stored. Massive notes were taken to emphasize the lessons learned and assist the unit should the day arrive for another move.

Early November found the officers and men of the unit starting to think about Thanksgiving and Christmas leaves. Little did they realize that Thanksgiving would be spent on the Pacific Ocean and Christmas would be a sacred moment or two in South Vietnam, crammed between maintenance or missions. Again came the "word," but the procedures were old hat. Inspections, checks, allotments, etc., were more or less routine. In four days, 100 percent of all TOE aircraft were flyable and ready to depart.

At 1000 hours, 6 November 1961, twenty CH-21s departed Gray Army Airfield, Fort Lewis, Wash., for Stockton, Calif. At 1900 hours, 8 November, 20 helicopters arrived on schedule without incident. This included a night flight over the Sierra mountains which reached an altitude of 10,500 feet.

On 21 November the *USS Core* departed for "destination unknown" with its small flight deck loaded to capacity with white, ghostly shaped CH-

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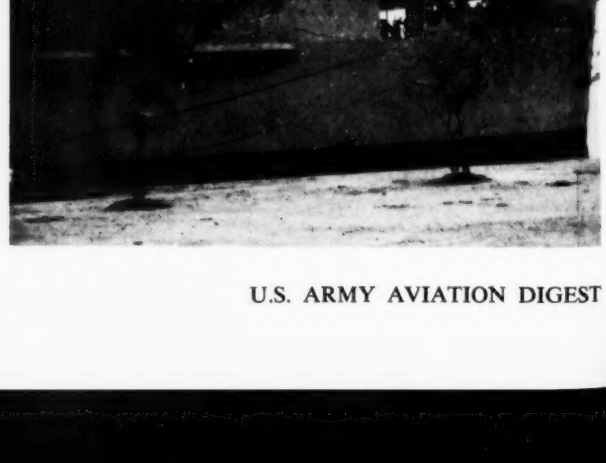
Maj Cherne is dual rated with over 2300 flight hours. He is Chief, Armament Branch, Avn Combat Developments Agency, Fort Rucker.



21s sealed and protected from the salt spray. Three weeks later crowds gathered to observe the banana helicopter on this flight deck along the dock in Saigon, Vietnam. Hundreds of people gazed with admiration at the big helicopters with "U. S. Army" boldly written across the side. As rapidly as possible the cocoons were removed, blades secured, engines preoiled and the ships readied for flight. The crowds waited expectantly as the first helicopter was pushed into position for runup. Smoke blew out of the stacks as the engine roared into action. Slowly the blades began to turn. Final rotor engagement was made, and the pilot completed his flight checks. Then with a powerful lurch, the first United States Army cargo helicopter to fly in South Vietnam lifted off the deck of the carrier and sped down the Mekong River to the Saigon International Airport. One by one the CH-21s moved noisily off the carrier to their new home in a strange, unfamiliar land.

The 22d of December 1961 will long be remembered by the men who served with this unit on that day. Operating jointly with members of the 8th Transportation Company (Lt Hel) a training exercise was conducted north of the city of Saigon. Everyone knew that this was a rehearsal for the real thing that was to follow. Thirty CH-21 helicopters, loaded to maximum capacity with crack Vietnamese paratroopers, raced across the docile countryside. Takeoff, checkpoints, release points and the landing area were hit with exact timing, indicating the degree of professionalism and training that these two units possessed. The training exercise was completed successfully in every detail and we knew that we were ready for the "big one."

At dawn on the morning of 23 December 1961, the pilots examined their aircraft with unusual thoroughness. Each item on the preflight checklist was carefully scrutinized. Simultaneously, the Vietnamese paratroopers quietly and orderly broke themselves into chalk loads and assembled around the helicopter that was to carry them into history.

Slowly the time passed: one hour . . . two . . . then three. The pilots laughed nervously as intelligence patiently tried to get a fix on the radio transmitter that we were after. Then the word came: GO! Thirty helicopters gained speed as they left the Saigon Airport behind, forming into right and left echelons to place the troops on both sides of a canal. On time and on target, the helicopters flared for a landing into an almost impossible landing zone: perpendicular rows of pineapple fields, with 3-foot troughs between rows filled with water and mud. If ever pilot training and technique paid dividends, this was the day. Small arms fire broke out immediately, and several of the aircraft were under fire as they departed the area to return for additional troops and reenforcements. As the aviators looked back they could see the cloud of black smoke and orange flames reaching for the sky. There was little doubt as to what had happened.

On the 24th of December, a Specialist-4 was reported kidnaped by the insurgent Viet Cong. The 57th and 8th Transportation Companies were jointly alerted to prepare to mass a large number of troops as soon as the location of this American soldier was determined. Frantic preparations were made to continue work on the helicopters for this most important mission.

On the 2d of January, his position was pin-

Army CH-21s take off from the USS Core

pointed, and for the first time a large number of troops were delivered into an otherwise inaccessible area. One thousand and thirty-six soldiers were flown into a hole in the jungle. The landing zone was approximately 300 by 150 yards. The ground was soft, and the zone was further restricted by isolated trees and brush growing at random. Towering jungle trees ridged the area that was our destination. The Viet Cong roamed at will throughout this dense foliaged sector. This mission was performed without incident, to the amazement of the Vietnamese staff and commanders, who were now grasping the importance of helicopters in their future operations. Now they had complete freedom of movement and greater flexibility in their fight against an elusive foe.

A one time priority of training became our goal. Helicopters departed regularly to train their infantrymen on the minimum procedures they must grasp before being sent on an assault mission. In three months, the 57th Trans adequately trained 26,000 men in the techniques of loading and off-loading. It took 18 seconds to on-load, and 12 seconds to off-load each aircraft. We now had the capability to move anywhere in the Mekong delta area and displace trained troops.

At first, the soldier was awed by the helicopter and fearful of the noise and vibrations. However, he soon came to look forward to an assault by helicopter. Slowly, the local commanders began to employ the helicopters in less stereotyped missions.

They began to flex their muscles and employ the helicopters with more and more confidence. Although mistakes were made, they were never made twice by the same commander. New ideas were sought and the aviators of the units, with their abundance of enthusiasm and immense background in helicopter techniques, assisted in every possible way. An entirely new concept in their thinking and maneuvering against the insurgent forces made the helicopter the most desired tool in their inventory. The ratio of troops employed to Viet Cong destroyed clearly demonstrated the soundness of helicopter vertical envelopment.

With the arrival of the United States Marine Squadron came an even greater lift capability. Instead of 15 or 16 choppers, we could now employ 30 or more. The Army men eagerly greeted the Marines, passing on to them the experience that had been gained during the many assault missions that had been flown.

In mid-April a massive mission of transporting 1,100 troops was jointly shared by the Army and Marines. These men were placed in a little-known area in an effort to suppress those who wished to overthrow the existing government. With minimum planning and liaison the mission was performed in training film style as each unit moved directly to the appointed place at the appointed time with split-second timing. The men were landed in flooded rice paddies, with mud and water up to their waists and chests—a feat deemed impossible just a few short months ago!

The vehicle, tactics, concepts, and techniques will no doubt change as we develop more experience in this relatively new dimension of ground warfare. But to change, modify, rework or revamp you must depart from the established. The established is the doctrine that the pioneers in Vietnam proved in their page of history.

Thousands of Vietnamese soldiers have been trained for heliborne operations. On-loading time for each aircraft is 18 seconds; off-loading, 12 seconds

All members of the team have responsibilities for accident prevention in Army Aviation. The commanders, Army Aviators, and maintenance personnel—all can and should promote

AVIATION SAFETY

Captain Joseph C. Boggs

THE WEATHER AT Checkout AAF on 10 October was an indefinite obscuration, 1 mile of visibility, fog and intermittent light rain. At 0900 hours base operations received a message from the local sheriff's office stating that a helicopter had crashed 3 miles southeast of Sawbuck. Immediate action was taken by base operations to place in effect their crash plan. Crash and rescue personnel arrived at the accident scene to find only the remains of a burned helicopter which had carried two Army Aviators and a crewchief to their deaths.

Two questions immediately came to the mind of the aviation safety officer: What caused this accident? Could it have been prevented? These same thoughts have surely passed through the minds of everyone in Army Aviation after hearing about an aircraft accident. Aviation safety is not the concern of the aviation safety officer alone, but must be the concern of all who are a part of Army Aviation. Everyone from the most senior commander down to the lowest ranking private has a share of the responsibility for AVIATION SAFETY.

A review of statistics on Army Aviation safety reveals that during fiscal year 1962 there were 360 major Army aircraft accidents. Sixty-nine crewmen and passengers were killed as a result. During the first half of fiscal year 1963, a total of 161 major Army aircraft accidents occurred, and 14 passengers and crewmen lost their lives.

These statistics readily reveal that a continued effort in accident prevention is needed. To be successful this effort needs the support and participation of *everyone* in Army Aviation. It has been proved that many accidents which happen could have been prevented. It's our job to

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Capt Boggs is assigned to the 1st Avn Co., 1st Inf Div. He is dual rated with over 2,000 flight hours.

learn the techniques of accident prevention and to practice them.

How are aircraft accidents prevented? There are many facets of an aircraft accident prevention program. They basically break down into two categories: preventing an accident before it happens, and preventing future similar accidents.

A properly conducted aircraft investigation is one of the most valuable tools the commander can use to prevent accidents. A poorly conducted aircraft investigation is next to valueless. The board that winds up with weak and inconclusive findings has done nothing to prevent future accidents. A good commander will not accept this type of finding because he knows that it can cause him to be faced with another accident from the same undetermined cause.

The aircraft accident prevention program needs the support and participation of all to make it a success. The commander can do a great deal of planning and directing but the details are up to all of us. An individual can do many things to promote aircraft accident prevention. Subsequent paragraphs list some of the responsibilities of the commander, the aviator and the maintenance support personnel to the aircraft accident prevention program.

COMMANDER'S RESPONSIBILITIES

The commander must know the accident business personally. He must understand that human errors cause 60 percent of our losses and that these are the easiest to eliminate. The commander has the responsibility to assure that an active aircraft accident prevention program is in effect within his command's safety program. In addition to approving the safety program, the commander must actively participate in and supervise its conduct. Leadership is vital in producing the desired results from the subordinates who must carry out the details of the prevention program.

Other responsibilities of the commander are to:

- Direct preparation and publication of SOPs and other directives which establish standard procedures and policies for operation of Army aircraft within his command.
- Ensure strict standardization of all aviators in types of aircraft which they operate.
- Ensure that all subordinate aviation units establish active aircraft accident prevention programs.

AVIATOR'S RESPONSIBILITY

The aviator has a large responsibility in the implementation of an effective aircraft accident prevention program. He should have a vital interest because it can mean the difference between failure or completion of the mission—or the difference between life and death. Let's investigate some of the ways in which an aviator can help prevent aircraft accidents.

The 6BX approach to physical fitness is designed to develop an adequate level of reserve energy needed for vigorous well being

The physical and mental condition of an aviator affects his ability to perform his flight duties. It is his responsibility to keep himself in good physical condition and within weight requirements. His ability to withstand fatigue is directly related to his physical condition. Aviators who deviate from their normal health posture should report immediately to the flight surgeon for diagnosis and treatment. Ailments should not be self-treated or withheld for fear of loss of flight pay. Withholding a health problem can cause mental anxiety which can result in inattention or a decrease in alertness.

The writeup of aircraft deficiencies is another very important responsibility of the aviator. A clear and concise writeup lets the maintenance people know what is wrong with the aircraft. Many times aviators exceed the maximum allowable rpm in helicopters or have hard landings in fixed wing aircraft and fail to write up these conditions. They seem to fear being questioned or that it reflects on their flying ability.

The aviator is responsible for writing up these conditions. Failing to do so means that maintenance personnel are not required to conduct an inspection on the aircraft for structural damage or other deficiencies. There may be no apparent damage; however, the overstressed condition can cause creep or fatigue failures to start in the aircraft. Proper inspections can reveal these deficien-

cies and corrective maintenance can prevent an accident due to materiel failure. Conscientious writeups of deficiencies noted on the aircraft can save lives and loss of aircraft. It is one of the best preventive techniques that the aviator has at his disposal.

Most accidents begin with some type of an emergency condition. The aircraft accident investigator has to ask himself these questions. Should the aviator have been able to cope with this emergency? Did this emergency end up in an accident because the aviator did not know the proper emergency procedures?

You are cruising along in a U-6A at 4,000 feet; suddenly you detect a large increase in manifold pressure and a large decrease in rpm. What is your emergency? What are your emergency procedures? The emergency is a propeller failure in flight. Your emergency procedures are as follows:

1. Put propeller control in high pitch.
2. Throttle back to an airspeed just sufficient to maintain flight.
3. Check oil pressure gauge. Even if oil pressure is low, it is possible to nurse the engine by keeping the rpm to a minimum and by keeping the engine as cool as possible.
4. Make an emergency landing with limited power. Most emergencies are not this simple. You are responsible for knowing the material in the -10 of the aircraft in which you are qualified. How well do you know the emergency procedures, operating limitations, weight limitations, and flight characteristics of the aircraft in which you are qualified? Could you pass a closed book examination on these subjects?

Most Army Aviators are qualified in two or more types of aircraft which they fly as a part of their normal duties. Instead of knowing one aircraft, the aviator must know several aircraft. The aviator should take the -10 of each aircraft in which he is qualified and make a comprehensive study of it. It is surprising how many little things one can forget, and probably a couple of big points, too. The more the aviator knows about the aircraft he flies, the better his chances are to handle that emergency which will arise. Many accidents in the files could have been prevented if the aviator had known his aircraft better.

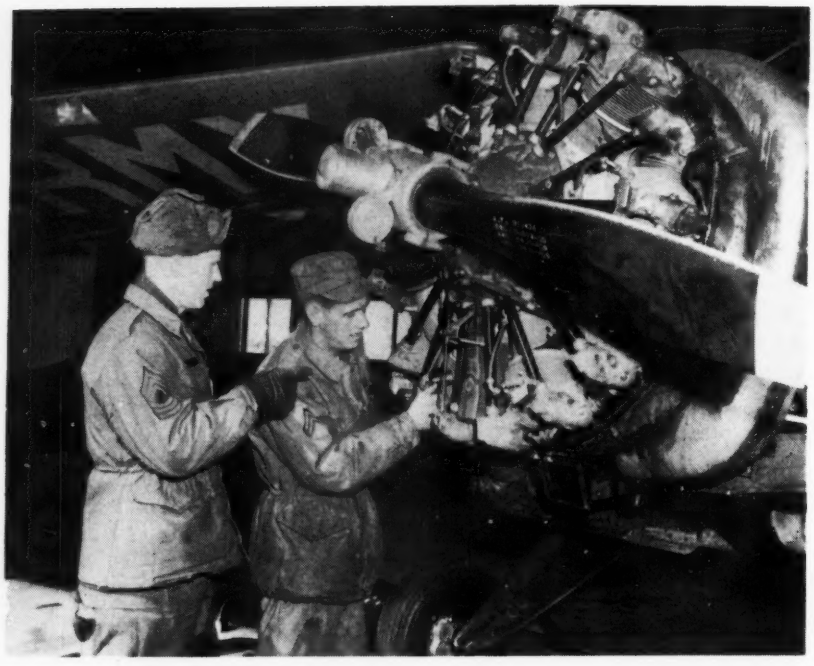
These examples of aviator responsibilities in aircraft accident prevention have merely scratched the surface. There are many other ways in which the Army Aviator is responsible for implementing the aircraft accident prevention program. It is an individual responsibility to do everything possible to improve aviation safety.

MAINTENANCE PERSONNEL RESPONSIBILITIES

Maintenance personnel also have a part of the responsibility in the aircraft accident prevention program. There are numerous ways in which they can help prevent accidents.

The majority of the prevention techniques in the maintenance field relate directly to the manner of performance of assigned maintenance duties. Maintenance errors can be caused by poor workmanship, resulting from a lack of training, inattention, or failure to follow published maintenance instructions. Inadequate inspections can also cause maintenance errors through absence of a qualified tech inspector at completion of maintenance, inattention by inspectors, or failure to perform functional checks or final test.

The prevention of maintenance errors depends primarily on the state of mind of the maintenance and supervisory personnel. Each man must take pride in his work and be personally responsible for its quality and completeness. The prevention of



maintenance errors will prevent aircraft accidents.

Aircraft accidents can be prevented. Enough facts are available to substantiate this. Many accidents that happened should not have happened. An effective aircraft accident prevention program requires the support and participation of every member of the Army Aviation team.

No matter what your particular job, *you* can do something to promote safer operations. This is the responsibility which rests upon each of us. If each of us carries our load, we will reduce the number of aircraft accidents. As members of the Army Aviation team we have the responsibility to learn and practice the techniques of accident prevention to promote better AVIATION SAFETY.

USATRECOM Tests 3-Bladed, Rigid Rotor UH-1B

OPERATING AT normal gross weight and power, speeds in excess of 147.0 knots have been achieved by a high-performance UH-1B research helicopter fitted with a three-bladed rigid rotor system.

USATRECOM reports that three different rotor systems are being test flown on the helicopter. Besides the three-bladed rigid rotor system, a three-bladed gimbal mounted rotor system and the UH-1 Iroquois series' standard two-bladed semirigid rotor system have been tested. [See back page January '63 DIGEST.]

Advantages of a rigid rotor system are simpler design, fabrication and maintenance; quicker response to pilot control, and indiscriminate loading with less regard for center of gravity.

Does accomplishment of your unit's mission suffer from a lack of trained helicopter instrument rated aviators? Need a helping hand to overcome this bottleneck? Maybe you can use this unit's POI as a guide to solving your problems.

A Small Unit

Instrument Training Program

Major Edwin O. Carr

HELICOPTER instrument flying, although by no means new or unusual, is still somewhat rare at division aviation company level.

The average line division in Europe is spread out over a vast sector. Even more dispersed than the average is the 4th Armored Division, with headquarters at Goeppingen, Germany. The problem of command control is such that a special aviation unit known as Detachment H has been formed from portions of the organic aviation company. The primary mission of the detachment is to transport the division commander and staff.

The nemesis of any aviation transport system is, of course, the weather. Attempting "all weather" operation with only a VFR capability has its drawbacks. Most helicopter pilots will readily agree that it is possible (I didn't say safe) to fly in ⅛ mile visibility and 30 to 40 feet of ceiling. But in Europe, with both departure point and destination reported open, zero/zero weather is often encountered en route. Consistent mission accomplishment requires a helicopter instrument flight capability.

All the aviators assigned to Detachment H were selected for their background and experience. All have current fixed wing instrument cards and all are superb helicopter pilots. The average experience level is in the vicinity of 1500 flying hours, usually about two-thirds fixed wing with approximately 20 hours of weather time and 100 hours of hood. The other one-third is helicopter time, usually split about fifty-fifty between reconnaissance (OH-13, OH-23) and utility (UH-19, UH-1B) helicopters.

The Bell UH-1B helicopter (six are assigned to Detachment H) is unusually well instrumented. It has more than

Maj Carr is dual rated and has over 4,600 flying hours. He is now assigned to the 40th Artillery Brigade, Presidio of San Francisco

In Europe zero/zero weather is often encountered en route while departure and destination points are open

enough radios and navigational aids to be a good weather aircraft, plus enough electrical backup for any eventuality (a 300 amp main generator with a 200 amp standby generator). It is exceptionally well powered and will climb over 1,000 fpm under most conditions. Also as helicopters go, the UH-1B is very stable. It has only a yaw instability, usually induced by a heavy foot on the pedals. The range, 2 hours and 40 minutes, is sufficient for most normal missions in Europe, especially in view of the low minimum and alternate requirements prescribed in AR 95-2. The machine presents no problem for use in weather.

Increasing the capability of Detachment H to include IFR operation meant bringing the men and the helicopters together to exploit the maximum capabilities of both.

A POI especially tailored to the situation was devised. In substance it consisted of 16 hours of flight instruction, 15 hours of ground school, and 2 hours of link. The course was organized to the extent that the flying periods were worked out according to lesson plan. This was necessary in view of the limited flying time available. It must be remembered that this unit had to continue its operational missions also.

Instruction was to be given in seven working days. By assigning two aviators and a UH-1B to this program, the operational mission of the detachment, although reduced, could be continued.

No unusual problems were encountered. By adhering to the POI, all eight rotary wing aviators assigned were rotary wing instrument qualified over a period of 44 days. This allowed a two-day break between classes plus weekends. The cost of this 100 percent rotary wing instrument capability was approximately 125 hours of UH-1B flying time.

The success of such a program can be attributed to three factors:

- *Continuity of instruction.* This means instructing in planned sequence, every day. In some cases the operational commitments of the unit made it necessary to fly during off duty hours. However, the results were well worth the extra effort.

- *Complete cooperation from the students plus a desire to learn as much as possible.* Motivation of the student is always 90 percent of the instructor's battle.

- *Complete, logical, and highly organized instruction.* Changing the flight instructor sets back the program and is poor procedure at best. Since the course was relatively short, this problem wasn't encountered.

Illustrated is a copy of the course used by this organization. It may not work for yours. In that case change it; add or subtract as necessary to meet the needs of your unit. If the average aviator in your unit is long on helicopter experience but gets lost in the vicinity of the VOR, increase the amount of radio work. Conversely, if you have "airline" pilots familiarize them with the "bush." Do whatever is necessary to adapt the program to your organization. Implementing such a course of instruction not only saves many taxpayer dollars but raises the training status and morale of your unit to a truly professional status. Try it and see.

[This POI is feasible only for aviators with a high degree of proficiency in rotary wing flying and fixed wing instruments. It is not considered sufficient for all Army Aviators. Editor.]

POI FOR R/W INSTRUMENT TRANSITION

16 hours flying
15 hours classroom
2 hours synthetic instrument trainer

Day	Subject	Length
1st (AM)	Aircraft instruments. Detailed discussion of attitude instruments available in the UH-1B.	3 Hours Classroom
1st (PM)	Demonstration of subject matter covered in AM period. Also, demonstration of pitch, yaw, and bank control.	1 + 30 Hours UH-1B
2d (AM)	Sensations of instrument flight. (Vertigo, flicker—how to combat and control them.)	1 Hour Classroom
2d (AM)	Instrument takeoff. Full panel climbs, descents, turns. Fundamentals of power control techniques. Control touch and control procedures.	1 Hour Classroom
2d (AM)	Detailed discussion of radio and navigation aids available on the UH-1B (ARC 73, ARC 44, omni, ADF) and FM homing.	1 Hour Classroom
2d (PM)	Demonstration of instrument takeoff. Practice of straight climbs and descents, descending and climbing turns. Two ADF approaches.	2 Hours UH-1B
3d (AM)	Discussion of emergency panel operations; when used. Techniques of cross-check. Partial panel approaches. Gyro out GCAs.	1 Hour Classroom
3d (AM)	Emergency procedures: fire, icing, engine failure. Use of parachutes; autorotation on instruments (full and partial panel); servo failure; use of copilot during emergencies.	1 Hour Classroom
3d (AM)	Rough air and turbulence procedures in rotary wing on instruments; use of trim. Effects of load, blade stall, accelerations.	1 Hour Classroom
3d (PM)	Review of all full-panel procedures. Demonstration of partial panel: straight climbs, descents, compass turns, climbing and de-descending turns, steep turns, unusual positions. Partial and full panel autorotation.	2 + 30 Hours UH-1B
4th (AM)	Weight and balance. Filling out weight and balance forms.	1 Hour Classroom
4th (AM)	Flight planning: clearance, altitudes, routes, differences from fixed wing. Techniques of airspeed computation in flight.	2 Hours Classroom
4th (PM)	Emergency panel, maneuvers, approaches. Gyro out GCA approaches.	2 Hours UH-1B
5th (AM)	Plan cross-country flight to Nurnberg via Dinkelsbuehl, with Illesheim as alternate.	1 Hour Classroom
5th (AM)	Fly planned cross-country in synthetic instrument trainer.	2 Hours Synthetic Instrument Trainer
5th (PM)	Review all previous work. Complete at least 3 approaches.	2 Hours UH-1B
6th (AM)	Fly IFR to Schwabisch Hall; shoot 2 approaches and return.	2 Hours UH-1B
6th (PM)	Review all ground school work previously covered.	1 Hour Classroom
6th (PM)	Written examination of all work covered.	2 Hours Classroom
7th (AM & PM)	Checkride in accordance with AR 95-63 and AR 95-67. IFR flight to Fuerth AAF and return (via Stuttgart).	All Day

prepared by
THE U. S. ARMY
BOARD FOR
AVIATION
ACCIDENT RESEARCH

TWX EXCERPTS

From March and April

OV-1

UH-1

U-1A

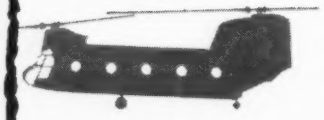
CH-21

O-1

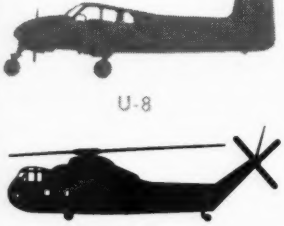
U-6

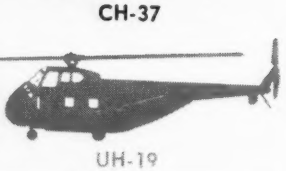
CH-34

CV-2


CH-47A

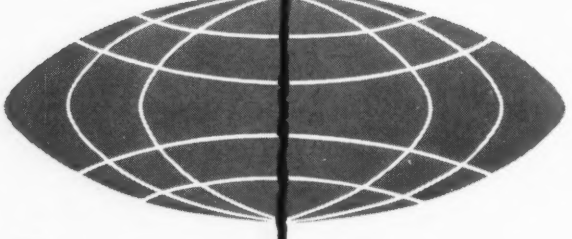
OH-13


U-8


CH-37

UH-19

OH-23



CH-37B EMITTED LOUD NOISE from transmission area during flight, followed by loss of rotor rpm. Rotor rpm could not be maintained and aircraft settled into rice paddy dike. Major damage to clamshell doors and right gear drag brace assembly. Caused by failure of main gear box.

CH-21C SKIN WRINKLE damage found after flight in which demonstration hovering autorotation was made. Suspect bulkhead damage.

UH-1B TAIL ROTOR FAILED during hovering flight. Aircraft assumed nose-low attitude, spun 270° to right, and crashed on ramp. Aircraft was total loss. Nut (P/N 204-010-711-1) had not been safetied to yoke assembly (P/N 204-010-781-1). Pilot sustained minor injuries.

O-1A SMOKE ODOR detected in cockpit, and smoke observed coming from under instrument panel in flight. Caused by loose wire to rotating beacon.

UH-1A ENGINE LOST OIL PRESSURE in flight. Successful forced landing accomplished.

UH-1A CABIN AIR SCOOP assembly was partially torn loose in flight. Caused by failure of scoop (FSN 1560-739-2586).

OH-13E STABILIZER BAR failed and separated from aircraft in flight. Severe vibration was experienced. Successful forced landing was accomplished. Caused by material failure of stabilizer bar tie rod assembly (FSN 1560-520-6080) at the inboard mounting point. Examination of inboard section of stabilizer bar tie rod assembly revealed that 50 percent of the bar had failed due to fatigue prior to loss of stabilizer bar assembly. Failure occurred approximately one-half inch outboard of stabilizer bar rod end nut (FSN 5310-478-5923) and perpendicular to the longitudinal axis of the assembly.

U-1A ENGINE RAN ROUGH and backfired during climb. Successful forced landing accomplished. Caused by crack in No. 3 cylinder.

U-1A EMITTED smoke through firewall into cockpit during flight. Caused by adjusting nut (FSN 5310-146-0781) on No. 9 cylinder intake rocker arm working loose and knocking hole in rocker box cover, resulting in loss of oil.

CV-2B LEFT MAIN GEAR collapsed during landing roll. Major damage to landing gear, left wing, left propeller, engine, and nacelle. Suspect failure of lower drag strut leg (P/N 5768-5).

CH-21C SETTLED during pinnacle landing, and right landing gear was broken off. Other damage included damage to bulkhead, right main landing gear castings, and fuselage skin. Uneven heating and up and down drafts caused by 26-knot wind in mountainous area considered factors.

CH-34A ENGINE BACKFIRED and lost power in flight. Caused by failure of No. 3 cylinder main intake valve spring (FSN 2810-326-0823).

OH-23D LOST POWER and emitted smoke from engine breather. Successful forced landing accomplished. Hole burned in piston assembly at point behind oil ring and extending 2 inches below oil ring to top of piston.

O-1E ENGINE FAILED in flight. Restart was made and successful forced landing accomplished. Engine failed twice while aircraft was taxiing on runway. Caused by fouled plugs in No. 4 and No. 6 cylinders. Water also found in fuel tanks.

UH-1A OIL TEMPERATURE rose above normal in flight. Caused by sheared oil cooler gear box driveshaft.

OH-23 EMITTED LOUD NOISE in flight. Aircraft was autorotated to landing. Support to cooling fan gear box broke, damaging gear box, fan, and fan shroud.

OH-23D ENGINE FAILED in traffic pattern during night training flight. Successful forced landing accomplished. Caused by thrown rod.

CH-37B IMPELLER SEAL FAILED during cruise flight. Successful forced landing accomplished.

CH-37B LOST POWER on No. 2 engine and backfired in flight. Caused by loose spark plug.

CH-47A LEFT ENGINE transmission oil temperature rose above normal in flight. Caused by broken wire at cannon plug.

U-6A TAXIED into post. Major damage to lower fuselage forward of tail wheel.

O-1A GROUND-LOOPED during landing. Major damage to wingtip, aileron, wheel, horizontal stabilizer, and fuselage. Caused by ruptured brake cylinder.

CH-21C ENGINE FAILED during pinnacle approach with sling load. Sling load was released and aircraft struck side of pinnacle. Major damage to landing gear and bulkhead.

OH-13E STRUCK ROAD SIGN with main rotor blade during low-level reconnaissance flight. Aircraft skidded 180°, landed on left side, and burned. Pilot escaped with scratch on left leg. Observer sustained lacerations of scalp and wrist and internal injuries.

The first airplane landed at the South Pole in 1956. Almost seven years later the first helicopters duplicated the feat.

UH-1Bs Reach the South Pole

Scot MacDonald, JOC, USN

AN IDEA, briefly flirted with during the early days of Operation DEEP FREEZE and abandoned, was resurrected recently, modified, and executed successfully. The idea: to fly helicopters to the geographic south pole. In neither instance was this a capricious whim, but rather it was a phase of an orderly plan important to the success of U. S. mapping efforts in Antarctica.

The feat was accomplished during the current DEEP FREEZE operation when three turbo-driven UH-1B Iroquois operated by U. S. Army pilots, serving with the Navy's Air Development Squadron Six, landed at the pole after a 185-mile flight from Mt. Weaver. This marked the completion of a project called Topo East, the accurate charting of a large area of the continent.

Topo East was the extension of two earlier Topo projects: Topo North and Topo West. The Topo projects were undertaken for the U. S. Geological Survey and assigned to the U. S. Army Transportation Board, Fort Eustis, Va. The detachment of aircraft, pilots, and support personnel was assigned to VX-6 to accomplish the job.

The arrival of the helicopters brings to four the total number of types of aircraft that have landed at the pole. The first aircraft to land at the pole was a C-47 *Skytrain* (R4D) equipped with skis and armed with JATO; it made the landing on 31 October 1956. Since then, P-2 *Neptunes* (P2V) joined other VX-6 *Skytrains* in making the pole trips. Only these two types aircraft landed at the pole in the succeeding years, until 1960 when C-130 *Hercules* joined the select group.

For two years the Army UH-1B helicopters have been used to transport U. S. geological survey engineers and their electronic distance measuring equipment throughout the Antarctic. [See "Peaceful Injun" November 1962 DIGEST.] The ultimate goal of Operation DEEP FREEZE is to create the first accurate map of the 5½ million square mile continent.

Pilots and crews of the UH-1B Iroquois helicopters which made the first helicopter flight to the South Pole

Official U. S. Navy Photograph

Chief MacDonald is an associate editor on the Naval Aviation News.

Start Your Flight Right!

Adapted from FAA Exam-O-Gram

HAVE YOU SEEN it happen—"cockpit complacency" turn swiftly into "cockpit confusion"?

It's a beautiful day for the gauges, perfect chance to boost your weather time a couple of hours. Nice smooth stratus all the way, no ice, no sweat, and home base forecasting a comfortable 1,500 feet overcast.

You taxi blissfully towards the runup area, anticipating a clearance, "via flight plan route," and a steak with "Sweet Thing" upon arrival. Everything is shipshape: Flight plan filed, route familiar, charts on your knee, ground operations complete except for runup and copying the clearance. As you check your flight instruments, Ground Control (obviously busy and hurried) calls you:

"Army 64025, ATC clearance, over."

Curses, a squirt of adrenalin, you are used to getting your clearance after runup, not while you are busy taxiing, performing instrument checks, and watching out for other ground traffic. You switch the transmitter selector.

"Army 64025, ready to copy."

Back to intercom. Screech! Parking brakes on. Clang! Your kneepad bounces to the floor; you dive to retrieve it. The pencil slithers down into your boot. Good grief, the parking brake releases. More adrenalin; head back up as you lurch across the taxiway and Ground Control rattles off the clearance. The Finnegan pin falls off your mike boom. Your cigar (unlit) drops down the front of your flight suit. CHAOS.

Farfetched? Hardly. Instructors can recall a variety of reactions to an unexpected call from the controller, including loss of aircraft control, violent application of brakes, and other evidences of dementia in the cockpit. The solution? A simple reply. "Army 64025 unable to copy. Will request clearance after runup." This allows the controller to get on with his work and lets you tend to the business at hand until you are ready for the clearance.

The phrase "ATC clearance" commonly arouses a sense of urgency in the pilot, especially when the controller is obviously in a hurry to deliver the clearance. The student prone to "checkitis" or the inexperienced pilot is likely to react with confusion, attempting to copy with his hands already full, or trying to memorize the clearance and request a readback of portions missed. The obvious point is worth stressing:

DON'T SAY YOU ARE READY TO COPY UNTIL YOU ARE READY!!

Unfortunately the controller has no way of distinguishing between you and the pilot who knows the local area as well as he knows his favorite martini recipe. The controller assumes that you are a competent pilot, that you have learned—and are proficient in using—clearance shorthand, and that you are familiar with appropriate route data. "Ready to copy" should mean at least the following:

- The aircraft is under control, preferably stopped, parking brake set.
- You are ready with writing materials, not scurrying around a disorganized cockpit groping for wayward pencils, paper, etc.
- Your radio(s) are tuned properly, volume at a readable level.
- Appropriate route data is handy. Your flight planned route may not necessarily be the one specified in your clearance. If the routing is different, don't read back until you have checked it. The fact that you read it back just as you received it (or faster) is no guarantee of your ability to comply with it. In accepting the clearance, you also assume responsibility for compliance. Better to take time to be thorough on the ground than to face confusion after takeoff.
- If you have requested a SID (Standard Instrument Departure), you have indicated to ATC that you are familiar with the route(s) and have a copy of the appropriate SID in the cockpit.

Start your flight right. "Confused" is a state of mind more appropriate to completion of income tax forms than to an instrument clearance. Pop out of that overcast after an uneventful flight and no one will begrudge you a perplexed moment as you guide your automobile out of the parking lot.

MAN TO MAN

AT EVERY LEVEL of maintenance there are supervisors. We know that because they are assigned as such to wear badges that say they are. But then again, are they? Do these personnel know what really goes into making a good supervisor?

The following questionnaire vividly points out the tasks of the supervisor:

DO YOU

Make sure newly assigned personnel know and understand the local rules and regulations regarding ground safety, maintenance policies, duty hours, uniform requirements?

Hold regular meetings with your people to talk over new or revised maintenance directives and policies?

Hold regular safety meetings?

Assign specific duties to individuals?

Delegate authority to assistants?

Discipline as necessary?

Bawl out in private only?

Enforce all directives and make sure your people comply?

Schedule leaves and passes by talking with your people so everyone gets his fair time off?

Insist on quality work from your people?

Require re-do if work is not up to quality standards?

Accept suggestions from your people relative to job improvement, improving working conditions?

Make suggestions for improving procedures, policies or directives?

Investigate poor performance and help to correct the cause of the condition?

Ask for help from your aircraft maintenance section back-up when necessary?

Ask for support from other maintenance activties as necessary?

Insure leaves and passes are scheduled evenly through the year so there are no periods of minimum present?

Discuss good as well as bad points with your people, individually and privately?

Answer the questions your people ask you, or if you don't know, find the answer for them?

Review your workloads frequently to insure that first things come first?

Insure that all required parts and supplies are on hand or on order?

Replan or reschedule work insofar as you are permitted to get the most done with your assigned people and equipment?

Insist on economy?

Check your people to insure minimum waste of time, supplies, equipment, electricity, water, etc.?

Keep records of overtime by each individual so that pass time is fair?

Review your manhour reports to learn where your activity can be improved?

Recommend T. M. changes where justified?

Frequently check work in progress and work completed to insure satisfactory quality and craftsmanship?

Know and use the established time standards for jobs done by your activity?

Frequently check the tools and equipment of your function and insure that all necessary maintenance, repair, calibration, etc., is accomplished when required?

Insure that the hand tools of your personnel are serviceable or turned in for repair or replacement?

Constantly check all facilities for proper utilization or recommended utilization?

Continually check on machines and other equipment for adequacy and serviceability?

Know the method by which you are to get supplies?

Regularly visit the maintenance control activities to check on the records and reports pertinent to your function?

Last but not least, set a good example for your men?

NOTE: Any answer but YES indicates an area of weakness in your supervisory activities. These are the areas to be concentrated on for improvement.

(Adapted from APPROACH Magazine)

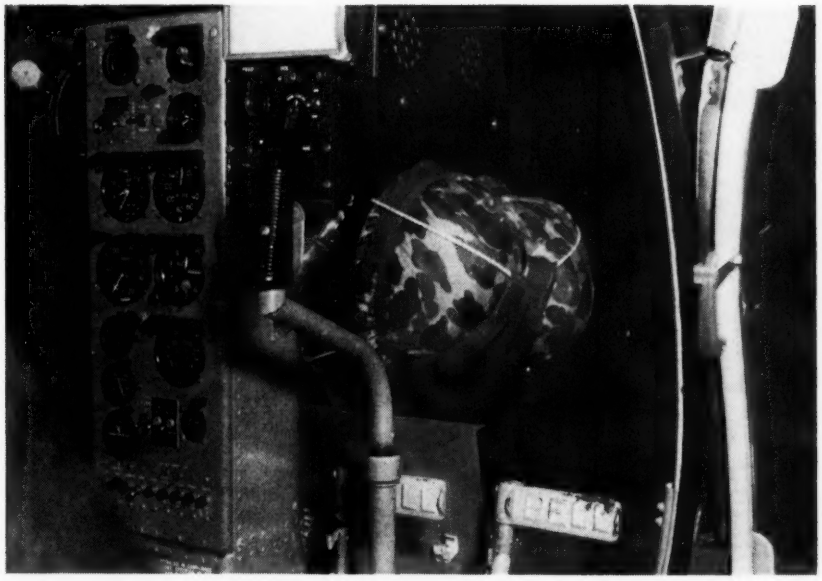


Figure 1

Who's Got A Secret?

ARMY AVIATION units in the field are continuously overcoming through field expediency many problems and obstacles. But why keep these solutions a secret? Many others are encountering the same or similar problems but have not yet discovered the answers.

An exchange of ideas through the DIGEST may not only help solve another unit's problems, but such an exchange will also stimulate initiative and result in new ideas.

Figure 2

Troops in the field often find small items that were overlooked when a piece of equipment was designed. For example, where do you carry your steel helmet while you're flying a helicopter? This may *seem* unimportant, but in the cockpit of a helicopter a loose steel helmet could wind up jamming the control pedals. It has happened, and proved quite embarrassing to the pilot. His passenger, a general officer, had to come to his assistance (see "The Clank Story," DIGEST, November 1961).

The DIGEST is not advocating that units in the field make unauthorized modifications on hardware. However, many improvements can be legally made. Informal exchange of information is not enough; if the Army

Figure 3

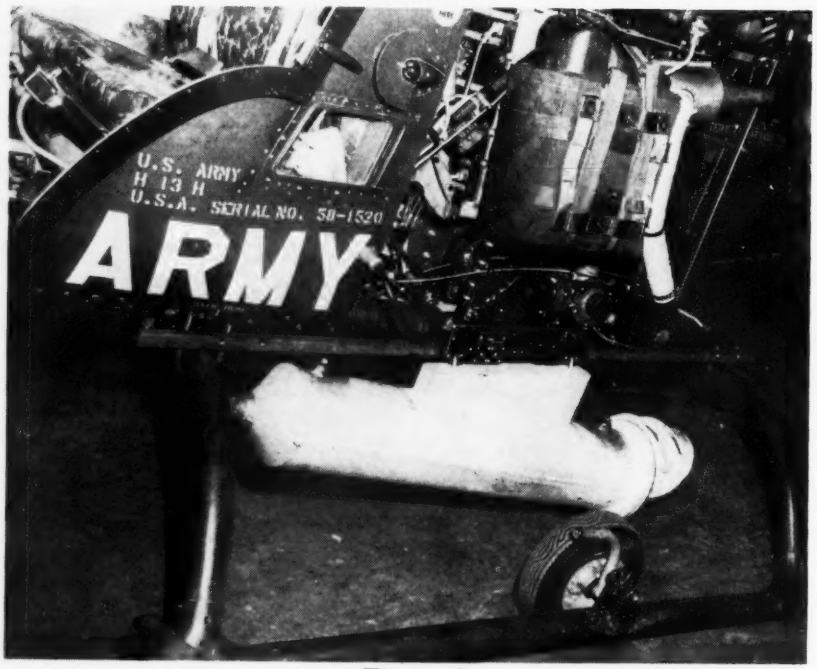
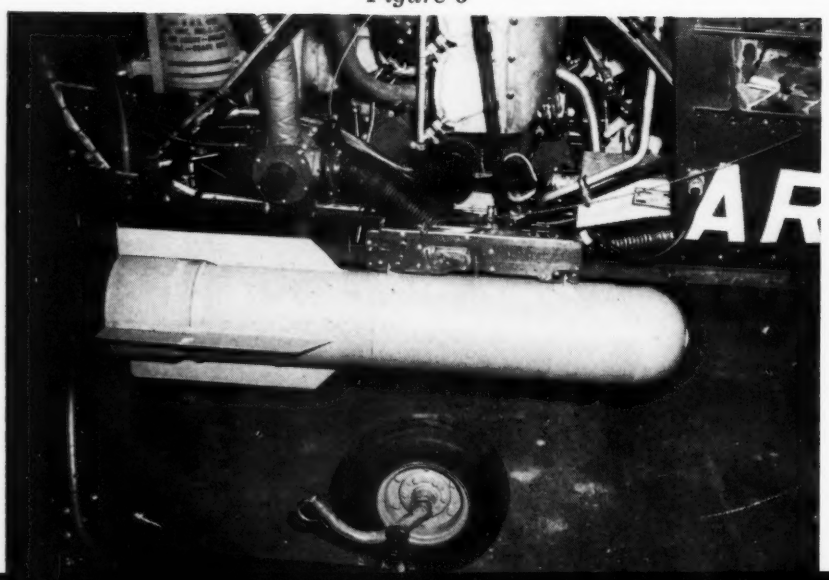


Figure 4

Figure 5



is to fully benefit from new ideas, they *must be* submitted through R&D channels. No matter how insignificant an idea may seem, it is welcomed and thoroughly analyzed in R&D channels. You don't have to work out detailed layouts and graphs depicting your idea. Just jot it down and submit it to the Combat Developments Command, Fort Belvoir, Va., or to the appropriate combat developments agency.

* * *

The following pictures and captions were submitted by Captain Ralph Broman while assigned to the XVIII Airborne Corps. They depict a number of ideas developed by personnel of the XVIII Airborne Corps over the past few years.

A simple installation of a helmet rack on the radio console of an OH-13 keeps steel helmets handy and securely in place (fig. 1). Attached by using existing console bolts, the rack does not hamper visibility or upset the center of gravity. The rig is made of any durable material plus a small amount of webbing and elastic cord. A closeup of the helmet rack removed from the OH-13 is shown in figure 2.

Nylon webbing, buckles and rings are all that's needed to make good tow straps (fig. 3).

A 5-gallon "jerry" can fastened to the side of an OH-13 (fig. 4) provides that extra gas needed on field problems. A bag made of webbing and felt (or similar material) is easily attached to the helicopter.

Standard 0-1 bomb shackles mounted on an OH-13 (see "Aerial Delivery of a Fire Bomb," DIGEST, March 1963) are used by the XVIII Airborne Corps to carry the M-26 parachute flare (fig. 4) and smoke tanks (fig. 5).

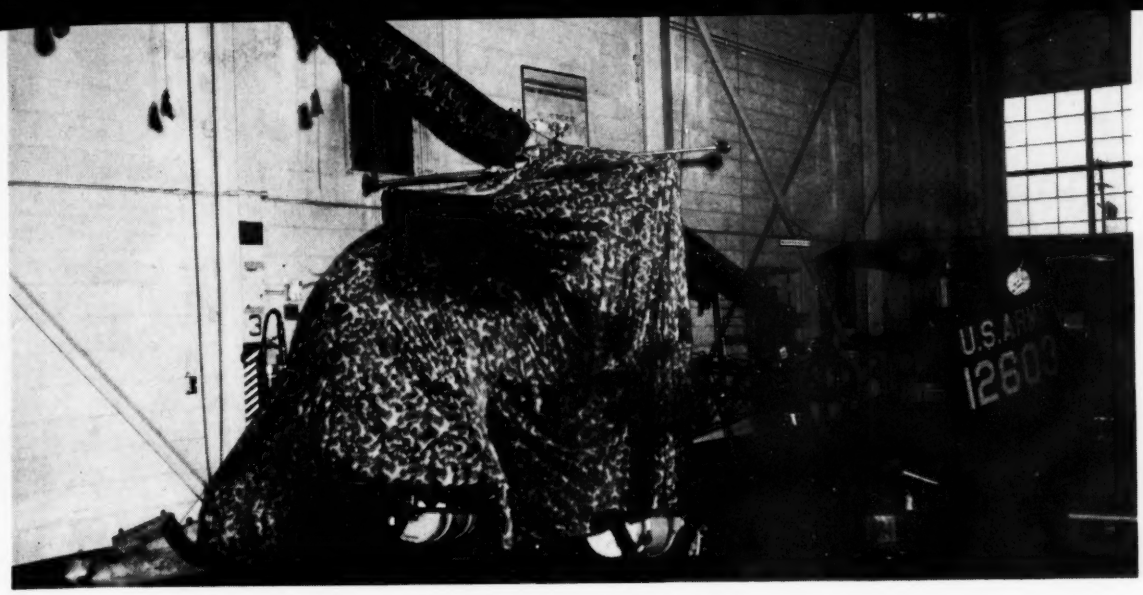


Figure 6

Salvage parachute material is used to make an effective camouflage cover for the OH-13 or UH-1 helicopters (fig. 6).

A glide slope indicator made by personnel of the XVIII Airborne Corps is shown in figures 7 and 8. The indicator, contained in a .50 cal ammunition box, must be flight tested at night before use in a specific area.

Figures 9 and 10 show a heliport landing light enclosed in a .30 cal machinegun ammunition box. These lights can also be used to mark fixed wing runways.

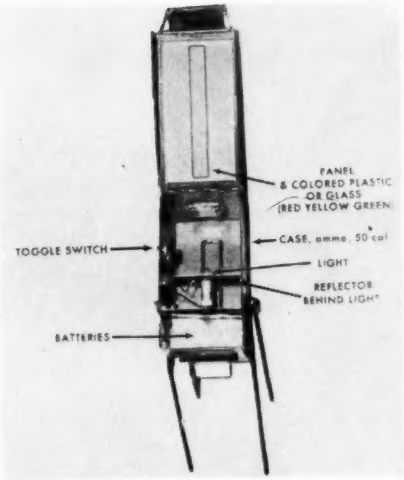


Figure 7

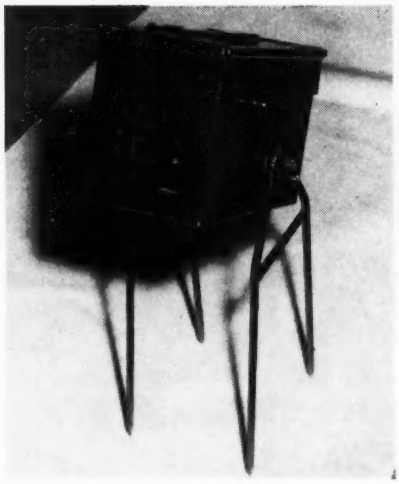


Figure 8

Figure 9

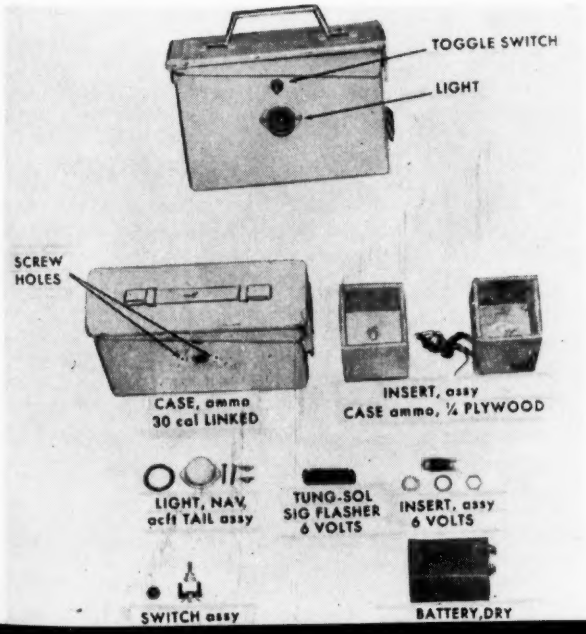
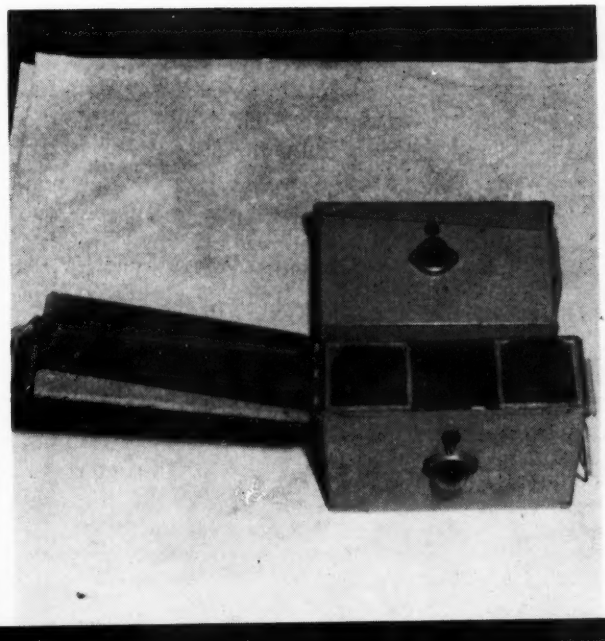


Figure 10



William H. Smith

"Some people are weather-wise,

But most are otherwise"

—Ben Franklin

THE JOLT WAS so severe that I thought I had collided with another aircraft. I was unable to keep my hands on the controls, they banged around so much."

The pilot who made the above statement had just had an experience that I hope none of us will have to face. He had flown through a thunderstorm. But he was not as foolish as you might think. He was especially trained and was flying an aircraft designed for the job.

He was talking about a 43 fps velocity updraft that struck the aircraft he was flying. An inspection of the airspeed-altitude recorder in his aircraft showed that it was carried from 14,800 to 20,000 feet in 70 seconds at an average rate of displacement of over 4,400 fpm. The maximum updraft recorded by the instruments during the displacement was at the rate of approximately 6,700 fpm. Considerable turbulence was encountered during the passage through the storm, and, although no major structural damage was incurred by the rugged aircraft used, skin cracks of up to 2 inches in length were found on the horizontal stabilizer at the conclusion of the flight.

Regardless of the engineering excellence of Army aircraft, they are not designed to stand the kind of stress encountered in thunderstorms. But it is possible that under conditions beyond his control, an aviator may find himself in a thunderstorm. Then his life, and the lives of others in the aircraft, may depend on his knowledge and understanding of the conditions around him.

THE THUNDERSTORM

Along the front and at the base of a violent cumulonimbus, there is a turbulent cloud known as the roll cloud, which should be avoided when circumnavigating the storm. It is usually forward of the precipitation area.

The thunderstorm itself is composed of several cells that

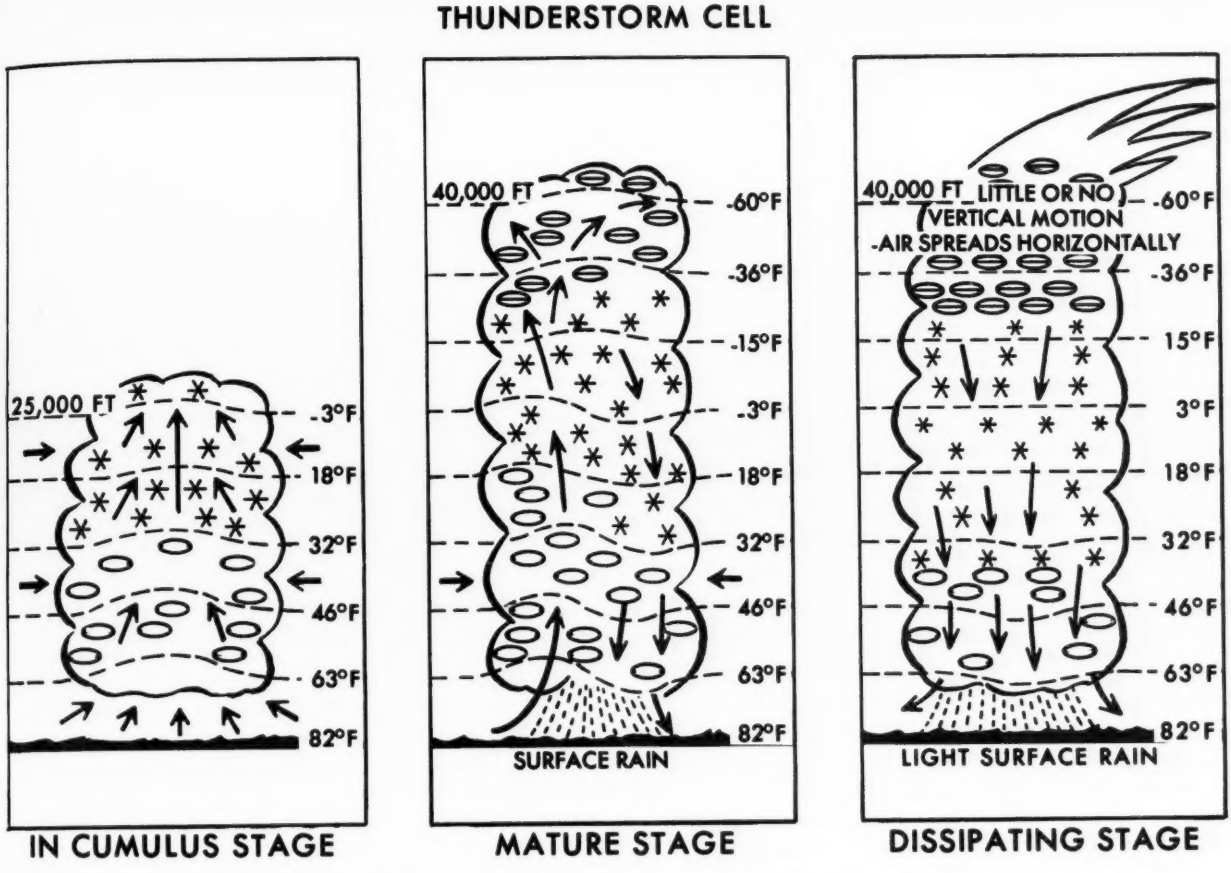


Figure 1

vary in diameter from 1 to 5 miles, depending upon the stage of development of the storm. The life cycle of these cells runs between 2 and 3 hours, and as old cells die, new ones build up to keep the storm in operation. The top of a full-grown cell has been measured as high as 67,000 feet. The anvil top of a cumulonimbus points in the direction the storm is moving.

The life cycle of a thunderstorm cell starts with an updraft, which may be of very considerable magnitude. The strength of these updrafts increases with the height. The tops of the clouds at this cumulus stage are about 15,000 feet but are rapidly rising. Large amounts of moisture and, above the freezing level, ice crystals form within the updraft, a part of which may be falling out of the edge of the updraft. To the pilot flying through the thunderstorm, this stage of development is characterized by a cloud so dense with misty rain that it is difficult to see the wingtips.

When the load of rain or ice within the updraft becomes so large that they cannot be supported by the updraft, they begin to fall, and the cell passes into its peak or mature stage. About the time the rain first reaches the surface of the ground, a complete change takes place within the cell structure. It is like a windsock which is suddenly turned inside out to point in the opposite direction. A strong downdraft develops in regions where updrafts previously existed. They are created and kept in operation by the downward drag of the rain and ice particles acting mechanically on the air, as well as by the sudden cooling effect of the ice particles falling through the lower air from their previous high-altitude position.

During mature stage, the cell usually will contain a sharp updraft and a strong downdraft adjacent to each other in the lower altitude levels.

In the dissipating stage of the cell the downdraft prevails in all but the highest altitudes, but the vertical downward velocities are less than 1,200 fpm, and

Figure 2. Winter thunderstorm frequency.

the amount of water stored in the cloud has decreased so that only light rain remains below the freezing level.

FREQUENCY OF OCCURRENCE

Thunderstorms occur in practically all sections of the United States. Figure 2 shows the average number of days with thunderstorms during the winter season. During this period thunderstorms are quite infrequent, except for a small area in the lower Mississippi Valley.

As spring arrives, the frequency increases quite rapidly. As shown in figure 3, the southeast area of the United States has ten or more thunderstorm days during the spring. During this period the highest average is near the Texas-Oklahoma-Arkansas border, where at least 20 out of the 90 days have thunderstorms.

Figure 4 shows that the average number of days with thunderstorms during summer increases over the average for spring. During the summer season an area of high frequency of thunderstorms (30 or more days with thunderstorms) extends from central Arizona into New Mexico and then northward over the central Rocky Mountain area and its eastern slopes. In the southeastern states there is another area of high frequency of thunderstorm occurrence.

In the fall the average number of thunderstorm days decreases rapidly (fig. 5).

In figure 6 (page 38) it can be seen that the average number of thunderstorm days per year is greatest along the Gulf Coast and least along the Pacific Coast.

HAIL

It has been said that aviators can recognize hail producing thunderstorms by the greenish hues and other colors found in them. This theory, though, has not been proved. Actually, it is now believed that every thunderstorm produces hail in some form above the freezing level. In general, one storm in 800 produces hailstones as large as walnuts, and about one in 5,000 provides a small shower of hailstones as large as baseballs. An average of 44,000 thunderstorms occur per day on the earth.

In the continental limits of the United States, hailstones occur at any time of day or night, in any season. The greatest frequency of large hailstones is found in an area about 500 miles wide, running from Texas north through western Nebraska and

Figure 3. Spring thunderstorm frequency.

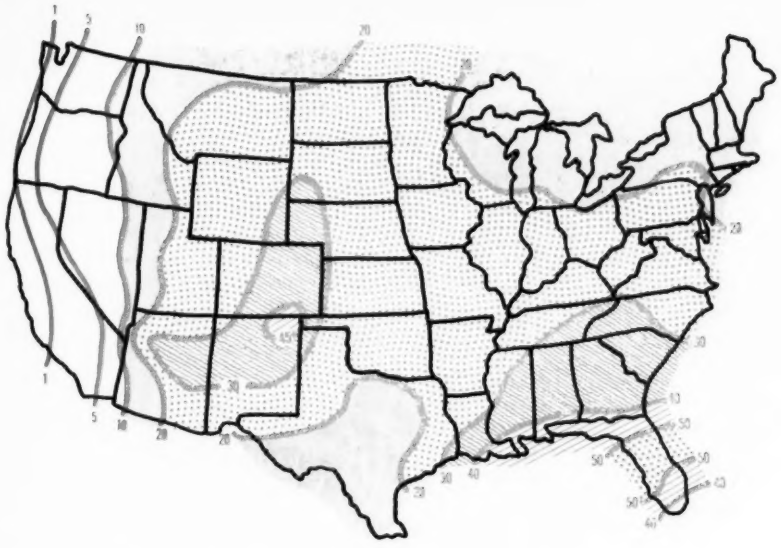


Figure 4. Summer thunderstorm frequency.

eastern Colorado on up into Canada.

About 60 percent of the time, hailstones are associated with coldfronts or prefrontal squall lines. Squalls usually appear in the afternoon; so more hail can be expected between noon and 8 P.M. than at any other time of day. Hailstones are found most frequently during April and May in the region around Texas, and farther north most frequently in June and July.

Scientists are still not sure of the way hailstones are formed. They know, for instance, that hailstones develop during the mature or peak stages of a thunderstorm. But some think that ice particles are tossed about by updrafts and downdrafts and accumulate a coat of ice when they are thrown in a freezing area. Others say that they are held in suspense by updrafts long enough for the layers of ice to form by coalescence. But it doesn't matter to the aviator how they are made. They are still dangerous, especially to the jet and turboprop aircraft that might ingest them into the engine.

ICING

Icing can be troublesome in thunderstorms when the temperature is at or below freezing. Under these conditions, supercooled droplets can form ice on airframes, affecting the flight characteristics of the aircraft. The danger zone for carburetors is from about 18° above to −10° C. Carburetor heat should be used in or near thunderstorms, and a constant check should be made for manifold pressure drop, which indicates the beginning of carburetor icing.

LIGHTNING

Even the most experienced aviator can be frightened when lightning strikes his aircraft. One aviator reported a strike which bent the pitot tube 15° while flying through heavy snow at 26,000 feet. The aviator said it sounded like an 88mm artillery shell. "A sheet of flame simultaneously enveloped the entire cockpit. My airspeed indicator jumped from 190 to 500 mph and stayed there. Everything looked a bit fuzzy. The air was so turbulent and the instruments jumped around so much that I couldn't tell for a moment what was going on. I just let the aircraft buck through. After what seemed like hours, the airspeed came back to normal."

Later investigation revealed that the airspeed indicator maintained an erroneous 500 mph reading for approximately 30 seconds, probably due to the

Figure 5. Autumn thunderstorm frequency.

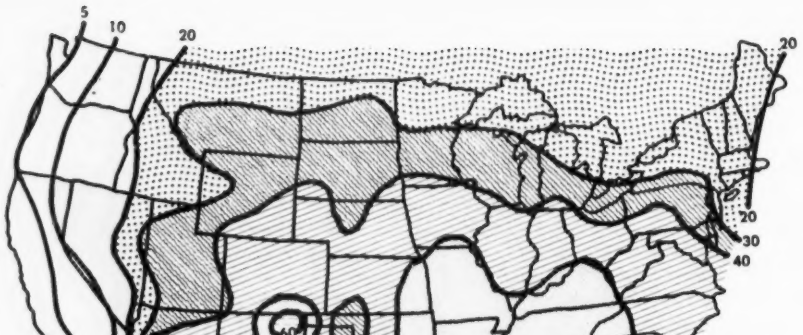


Figure 6. Annual thunderstorm frequency.

damaged pitot tube. Other than that, there was no damage to the aircraft.

Actually, a lightning strike is more startling than dangerous. The aircraft acts as a faraday cage in that it shunts discharge currents around the occupants of the airplane. The greatest damage usually reported is burned-off radio antennas or other protrusions, and the burning of small holes in the surface, wingtips, rudders, and elevators.

The flash can cause sudden blindness to those not wearing dark glasses, which may last long enough to result in more serious situations. In the lightning strike mentioned above, a crew member was not wearing dark glasses. As a result, he was not able to see well enough to read instruments for about two minutes after the strike.

There seems to be a correlation between the speed of the aircraft and the frequency of lightning strike. About 72 percent of all lightning strikes occur above 180 mph. This is because the faster an aircraft flies through a thunderstorm, the more rapid is the rate at which it will produce and acquire charges, and the charge accumulation will increase in proportion to the square of the speed.

An aircraft is not likely to be struck unless it encounters moderate or severe precipitation static or St. Elmo's fire discharging from the sharp corners of the aircraft, such as propeller, wingtips, etc. If the precipitation static or St. Elmo's fire is severe and outside air temperature is between the freezing level and 15° F, the aviator should immediately seek a level above or below that temperature band and slow down to as low a speed as is safe, consistent with control of the aircraft. There is a tendency for St. Elmo's fire and precipitation static in the radio to build up rapidly in intensity. This can be regarded as a warning that a strike is imminent.

Some aviators report that turbulence is greater when the lightning is from cloud to ground than from cloud to cloud. Within certain limits this is true. Cloud to ground strikes occur frequently in the mature stage of a storm cell, and the sharpest turbulence occurs at this time. As the cell gets older, lightning strikes occur from cloud to cloud and the turbulence is less.

THUNDER

Thunder is the least troublesome part of a thunderstorm. It is caused by the very rapid expansion of the air in the path of the lightning stroke. This expansion results from the sudden heating of the air by the lightning.

Thunder is often heard as a roll rather than an instantaneous blast because it is produced all along the path of the lightning stroke and it takes longer for some portions of the thunder to reach the listener than other portions.

If you can't
go over . . .
go around . . .
go under . . .
go home!

This is the best advice that can be given an aviator who is caught in a thunderstorm.

But suppose a situation exists where it is necessary to fly through, how does an aviator go about it. He looks for areas of least precipitation and flies through that area. This way he avoids the worst turbulence and maintains the best visibility possible.

If the aircraft is capable of high-altitude flying, it may be possible to go over the anvil top. Going under is not advisable, especially if the terrain is mountainous. Or the aviator may go around. In any case, he must know the conditions on the other side of the storm, as the one he is facing may be only one of many in the area.

In considering the possibility of going over the storm, he must know the height of the anvil, which varies in different sections of the country. Summer storms in the southern part of the United States are very high,

usually 35,000 feet, and have been reported in excess of 50,000 feet. Farther north they get lower until up in the polar regions they are only 12,000 to 15,000 feet high. In the middle latitudes, it is sometimes possible to fly around the individual thunderstorm clouds. This usually can be done at an altitude of 15,000 to 20,000 feet, but a minimum of 5,000 feet horizontally and 500 feet vertically should be maintained from the clouds.

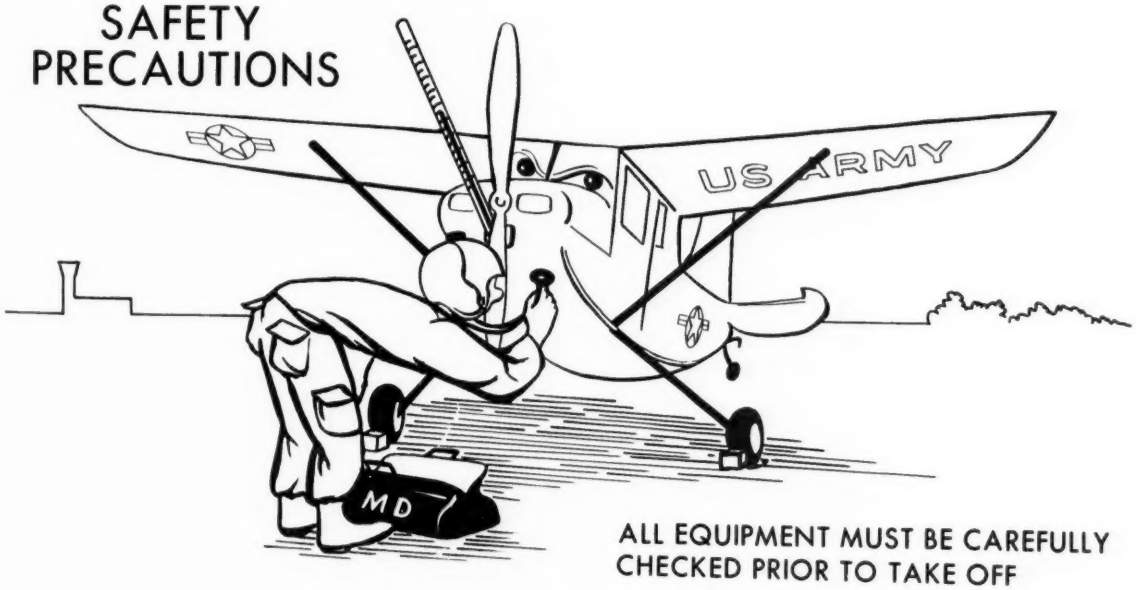
Before penetration, the airplane must be readied. The aircraft should be trimmed for straight and level. Turn on the pitot tube and carburetor heat. Check instruments, lights, deicing and oxygen equipment, safety belts, mixture, rpm, manifold pressure, etc. Turn on the cockpit lights to full brilliance. Tune the radio to the station that will be used all the way through the storm and do not change this setting until on the other side of the storm. In other words, the aviator should know that every thing is ready by the time he hits the storm. The moment the aviator notices strong crash static (if he is on instruments) he should slow down to the best penetration speed and keep the aircraft prepared until he is past the storm. After he hits it he will feel as if everything is happening at once and there will be no time for small details.

After entering the storm, let the aircraft ride it out. Attempts to maintain a constant altitude within a thunderstorm may lead to fighting the aircraft and a resulting dangerous increase in stress loads. Smooth pilot technique is extremely important, and attempting to maintain a constant altitude in heavy updrafts or downdrafts can get the aviator into serious trouble. On instruments, check with ARTC for other traffic and determine how much altitude leeway you have.

And don't chase the airspeed. This will only result in excessive attitudes, and it is easy to visualize the result of the nose being high and a sudden gust increasing the angle of attack to a stall. Use thottles only when the high or low airspeed limits are exceeded. Remember, the heavy rain may slow down the indicated airspeed reading as much as 70 mph because of partial blocking of the air entrance of the pitot tube.

Once in the storm, maintain the original heading. This is the quickest way out. Don't make any turns unless absolutely necessary. The turbulent area of most thunderstorms is only 10 to 20 miles. By the time the aviator changed his mind and decided to turn around, the chances are that he would have already penetrated the worst of the storm.

The sensible aviator avoids thunderstorms. He knows they rarely last long; nor do they hang around in one spot. When thunderstorms are active in your area, STAY ON THE GROUND!



Spark Plug Fouling

Lieutenant William J. Hodnett

DO YOU TAKE THE spark plug for granted, assuming that it will always function perfectly, igniting the fuel in your aircraft engine? The general reliability of spark plugs and the dual ignition system tend to tempt many aviators into making this assumption. However, *some* conditions under which the spark plug operates do cause complications and operational problems.

One of the main problems is spark plug fouling. Fouling is simply the accumulation of undesirable deposits onto the combustion end of the spark plug. Fouling may result from lack of preventive procedure, lack of care in maintenance and preflight operation, or from the accumulation of operating time and the normal need for plug replacement. Five principal items cause this condition:

- lead and its compounds,
- carbon from fuel and oil,
- graphite from thread lubricants,
- preservative compounds in the oil,
- metal or silica particles.

Let's take a look at the effect of fuel on spark plug fouling. Tetraethyl lead is used in aviation fuels to raise their "antiknock" rating. After combustion of the fuel-air mixture, the lead forms deposits. Formed in sufficient quantities, it provides a leakage path from the center electrode to the wall of the spark plug, causing it to short out.

To keep the lead from fouling the spark plugs, other compounds are used. One of these is ethylene dibromide. When mixed with tetraethyl lead in just the right proportion, combustion will convert the lead into lead bromide, a powder which will be blown out the exhaust. However, the lead and bromide do not always combine in the proportions to obtain the intended results. One reason the two compounds do not mix in the proper proportions is the design of the intake manifold of reciprocating engines; the other is the difference in boiling points of the two compounds.

Because of the difference in their boiling points, the lead may not be completely evaporated when all of the ethylene dibromide has evaporated. Also, due to the shape of the intake manifold and the presence of liquid in the induction system, ethylene dibromide and tetraethyl lead are never uniformly distributed to all cylinders. Therefore, spark plug fouling is possible for cylinders that receive the most lead. (Fuel injection engines have a uniform distribution of the tetraethyl lead and ethylene dibromide and do not have this type of spark plug fouling.)

Under normal operating conditions, lead bromide will not settle in the engine; however, during idling the temperatures may not be high enough to prevent condensation of some of these products. As a result, spark plugs and other items in the combustion chamber or exhaust port may become fouled from deposits of lead compounds. These lead deposits can be driven off by periodically

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operating the engine in a higher power range for a short time during ground runup and taxiing.

What happens during extended lean mixture setting on a typical cross-country flight? Some of the excess oxygen present combines with the tetraethyl lead and ethylene dibromide to form oxygen compounds, thus defeating the original purpose of the lead and bromide. Some of these compounds have fairly low boiling temperatures also. Combustion chamber walls and sometimes even the spark plugs are cool enough to cause them to condense. The result is a gradual buildup of layers of deposits, which can cause misfiring. Lead oxide is is one compound formed.

A periodic shutdown of the lead oxide process about once every two hours, and a clean out helps, but a completely successful procedure has not been developed that will permit unlimited engine operation at cruising power using a lean mixture without spark plug fouling. The shutdown of the lead oxide process is accomplished by using rich fuel mixtures or prime. The excess fuel breaks down the oxygen compounds and gives the lead and bomide a chance to combine and be taken out though the exhaust.

If there is not enough bromide around, melted pellets of lead are formed that splatter around or run down the spark plug ceramic or cling to the electrodes and form a direct short. The amount of accumulation depends not only on the time the process has been going on, but also the various operating conditions affecting the temperatures and pressures under which the compounds are formed.

With so many variables, it becomes difficult to establish a standard procedure for prevention or elimination. Many procedures have been used with more or less success on different types of aircraft. A common factor seems to be a change in operating temperature and, almost as frequently, the use of richer mixtures. Other procedures are the changing of the power and mixture each hour or two while cruising, and a decrease in airspeed by increasing the drag.

Another fouling effect from fuel is carbon deposits. Carbon fouling from fuel is associated with a mixture too rich to burn well or so lean as to cause intermittent firing and consequent accumulation of oil and carbon on the misfiring plugs. These difficulties are almost invariably due to improper idle mixture adjustment, leaking primer, or carburetor malfunction. The soot that forms with too rich a mixture settles on the inside surface of the combustion chamber as well as in the exhaust system when the temperature is low, as in idling. At higher speeds or power settings, the soot is swept out or does not condense the charge in the combustion chamber. During idling, there is a tendency for oil to be sucked into the combustion chamber. This oil may mix with the soot and form "briquets" which form on the spark plugs, shorting out the gap.

When the engine is run at moderately high cruising manifold pressures on the ground, the carburetor delivers a fairly hot, lean mixture. There is additional turbulence and scribbling action of the hot gases swirling in the combustion chamber and an increase in the temperature of the operating parts, with a resultant thermal expansion. All of these tend to cleanse the combustion and spark plugs.

Graphite is another contributor to spark plug fouling. Careless and excessive application of thread lubricant to the spark plugs will allow the graphite to flow over into the electrodes and cause shorting. The elimination of the problems with graphite is up to maintenance personnel. They should apply a very small amount of the lubricant and make sure that smeared fingers, rags, or brushes do not contact the plug or any part of the ignition system except the spark

Whadaya mean your plugs are fouled?

plug threads.

Preservative compounds also cause spark plug fouling. Newly installed engines and those treated for storage usually are treated by adding a preservative compound to the lubricating oil. It is very important to eliminate all of this compound from the combustion chamber, intake pipes, exhaust system, etc., before the initial run.

Other causes of spark plug fouling are metal and silica particles. Abrasions caused from maladjustments or incipient engine failures can result in fine particles of metal passing through the engine to show up on the spark plugs. Sand and dust picked up can also combine with lead oxide to form lead silicate. This has a very low melting point and begins to flow and causes a direct short across the spark gap. Proper air filters can eliminate most of this trouble.

If a set of spark plugs foul out before their rated life, make a very close examination to determine the cause. This is not to save a few dollars on a new set of plugs, but it may save an engine or *a life.*

Tripartite Army Aviation

Lieutenant Colonel Morris G. Rawlings
U.S. Army Aviation CD Agency

TRIPARTITION is the act of dividing something into three parts. It takes a lot of Gaul to do that!

Tripartite Army aviation is not divisive. It is the serious attempt on the part of three sovereign nations to reach agreement in order that each may standardize certain military equipment, together with the operational, organizational, and logistical concepts for its use.

It is disconcerting to the Army Aviator to learn he cannot refuel outside his own sector; that he cannot obtain a standard bolt to attach the gamma to the frammis; that he cannot load exchanged ammunition into his empty weapon; that he cannot identify a friendly landing area except by the markings on parked aircraft; and that he has no common radio frequency upon which to air his gripes.

Therefore, Tripartite!

The first formal Tripartite Army Aviation Conference was held at Fort Rucker, Ala. in October 1959 with representatives from the United Kingdom and France in attendance. Although certain agreements were reached, a careful reading of the report will disclose that it was chiefly used as a sounding board from which each country could reflect its plans and programs to the others. Maj Gen Earnest F. Easterbrook, then commandant of the U. S. Army Aviation School and commanding general of U. S. Army Aviation Center, hosted the conference, and many Center experts made presentations.

The Second Tripartite Army Aviation Conference was held at Middle Wallop, England, in September 1961. This conference resulted in several agreements for which SOLOGs (Standardization of Operations/Organizations and Logistics) were to be prepared. Chiefly among these were ground handling and refueling procedures, and the terminology to be applied to roles and missions, landing areas, and facilities. Working groups gathered at Fort Rucker to undertake this ambitious program in October 1962, and hammered out agreements in four areas:

Standardization of the policies and procedures governing the regulation/control and identification of Army air traffic in the combat zone.

Those procedures and rules for homing and navigation in the combat zone as they affect Army air traffic.

The minimum terminal facilities for any type of Army airfield or heliport in the combat zone.

Some aspects of organization, layout, marking, and lighting of Army airfields (including facilities) in the combat zone.

It is exceedingly doubtful that these agreements will be approved and implemented in their present form. Not only must they be coordinated through each nation's forces, but they must then return to the Washington Standardization Office (WSO) where instructions for implementation are sent to all interested agencies. It is far more likely that a status report on each proposed SOLOG will be made at the next conference, scheduled for October 1963 in Canada, and a revision effort will be made at that time.

[In March 1963 the Australian Army accepted an invitation to join Tripartite. The next meeting will have four nations represented and Tripartite becomes a Quadripartite conference.]

The French-developed SS-11 is not the ultimate weapon for armed helicopters, but it is available and effective today. Here's some background information on its development.

SS-11 Weapon System

THE FRENCH officer stood on the crest of a hill in Southern France. From his vantage point he could see a jeep moving slowly along a path in a field. The jeep was pulling a trailer and was carrying what seemed to be a variety of equipment. A two-man crew was on board. Suddenly, the jeep darted behind a large bush and stopped. So far ahead that it could hardly be seen with the naked eye was a tank. One of the men in the jeep turned around and faced rearward. He worked a few levers, there was a soft whistling sound, and in a few seconds the tank exploded, bits and pieces of steel flying everywhere. The jeep moved on, apparently looking for more victims.

The French officer had seen one of the first demonstrations of the French SS-11 weapon system. He was impressed with its simplicity and accuracy. There was no doubt that here was a formidable weapon. But he was thinking of a new and probably more complicated job for the missile. The officer was from the French Army Aviation Center at Satory (near Paris), and he was concerned with the need for better fire support by aircraft. He felt that if the SS-11 could be fired from a helicopter it would help.

As it turned out, the SS-11 proved to be excellent for use on the helicopter. The French placed it on the Alouette II and III and the SE 3200. Thus armed, their helicopters became mobile elevated platforms for immediate and continuous fire support in mobile situations.

Then the French Army tried the SS-11 on fixed wing aircraft. Here they found one drawback: the aircraft had to be flying at speeds of less than 250 mph when the missile was fired. But the type of flying practiced by armies of the world would cause no trouble here. And so the Alezei, Corsair, Dassault MP 311, and the Fouga Magister got SS-11s.

Other countries became interested. Soon the SS-11 was adopted by NATO countries (except England, who is presently testing the weapon). In 1959 the U. S. Army procured the SS-10 (an earlier and lighter version of the SS-11) and ordered a few SS-11s for evaluation. In July 1961 the U. S. Army signed a license agreement to manufacture the SS-11 in the United States.

Today the SS-11 is being used in the U. S. Army Aviation program. Just what kind of weapon is the SS-11? Why is it so popular? Let's take a look.

The SS-11 is a missile that is guided remotely by a gunner, very much the same as a boy guides his model airplane as it flies round and round him in an open field. The boy controls his model airplane with two guide wires. By pulling on one wire and allowing slack on the other, the boy is able to make his airplane go up or down.

The gunner controls the flight of the SS-11 in much the same way. Two wires are payed out from the missile as it moves through the air. To guide the missile the gunner has a control stick which generates command signals through an electronic signal generator, selection box, a wiring harness and on to the missile.

The electronic signals sent to the missile through the guidance wires by the gunner result in the movement of "spoiler" devices or "jettavators" that move into or out of the jet stream of the sustainer motor, and thus deflect the missile in its flight path.

The missile is powered by a two-stage solid-propellant rocket motor. Its streamlined body is fitted with four equally spaced fins. These fins are set at an angle 1° to the centerline to provide autorotation about the roll axis.

The warhead is armed automatically 3.5 seconds after the missile is fired and is detonated upon impact. For antitank work, the hollow-shaped charge warhead is capable of penetrating the armor plate of tanks. With antipersonnel type warhead, a high degree of accuracy is retained. This makes the missile well suited against nests of resistance in guerilla warfare, which can be destroyed without unnecessary damage to surrounding buildings or the civil population.

Maximum practical range of the missile is about 3,800 yards. This is determined by the total burning time of the sustainer motor (about 22 seconds) and the amount of wire contained in the bobbin.

Minimum range is determined by the 3.5-second delay before the fuse is armed, and by the time it takes a trained gunner to gain control of the missile and align it on the target.

Firing the missile requires a coordinated effort between the pilot and the gunner/copilot. As the helicopter comes into the firing run, the pilot aligns it with the target. This is necessary, as the sight used by the gunner has a limited field of view.

When the target is in range, the gunner fires the missile and, after stabilizing it above the target, immediately visually acquires it in his sight and guides it to the target. As soon as it detonates against the target, the gunner presses the wire jettison switch. This fires an explosive bolt, freeing a green plastic assembly package with the wire connection that guides the missile.

A system has been devised which allows for jettisoning in an emergency. For instance, suppose there is a malfunction in which the missile fails to leave the launcher after being fired. It is possible for the pilot to drop the offending missile. In the case of trouble with the aircraft in which a crash seems imminent, the pilot can jettison all missiles at once.

Of course, the area where the missiles are dropped must be chosen carefully. If at all possible they should be dropped in unoccupied areas, preferably lakes or rivers.

UH-1A armed with SS-11 and aerial 30 cal machineguns on flex kit

The handling and storage of the SS-11 missile is no more dangerous than the handling and storage of other ammunition of similar nature. It is shipped and stored in a wooden missile container and is covered with a protective material to protect it from moisture and foreign matter. As long as it remains in this container it is relatively free from the elements.

However, some of the parts are rather fragile and where possible extra precautions should be taken. The missile must be protected from temperatures below −4° F and above 104° F. Also the missile must be protected against lightning strikes which can cause detonation. Similarly, the missiles must be stored away from powerlines and other electrical equipment that may be the source of electromagnetic waves. The missile should be stored pointing in a direction that would cause the least damage if it should fire accidentally.

The SS-11 is, of course, not the final word in aircraft missiles. But the firepower afforded by them will better enable the helicopter company to carry out its mission.

CONSOLIDATED DATA

Powerplant	two-stage
First-stage burning time	1.4 sec
First-stage burnout speed	330 ft/sec
Second-stage burning time	22 sec
Second-stage burnout speed	625 ft/sec
Length	46 in
Wingspan	19.7 in
Gross weight	63 lbs
Weight, including transport container	156.5 lbs
Minimum practical range	525 yds
Maximum practical range	3,800 yds

crash sense

PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

A Piece of Wire

ONE OF A FLIGHT of five, the UH-19C, with a pilot and crewchief aboard was on a cross-country flight. Due to reported winds aloft, the five Chickasaws were flying at approximately 150-200 feet above the terrain.

Suddenly, the pilot heard a loud noise in the aft section that sounded as though a cable had snapped. He immediately bottomed pitch to enter autorotation. Directly ahead and across his path were the tall poles and heavy strands of a high tension powerline.

The aircraft struck the ground in a tail-low attitude. The aft portion of the tail boom was severed. Impact, later estimated at 20-30 g, collapsed the landing gear and the bottom of the fuselage as the aircraft bounced and skidded to a stop, rolling to its right side. Fire did not occur and the pilot and crewchief escaped with minor injuries.

INVESTIGATION AND ANALYSIS

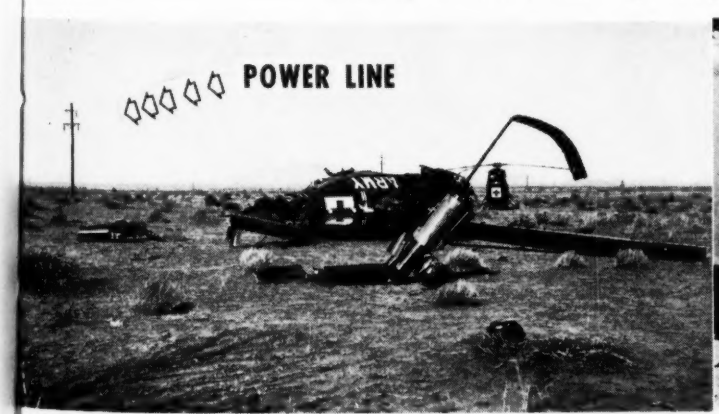
All flight controls were inspected for possible malfunction. Collective and cyclic controls, both lateral and fore and aft, were checked for continuity and found connected, except for numerous breaks due to impact forces. But the directional (antitorque) controls were found to have an open quick disconnect turnbuckle (FSN 5340-632-7C48) in the aft section. Further inspection revealed only crash damage to all other components.

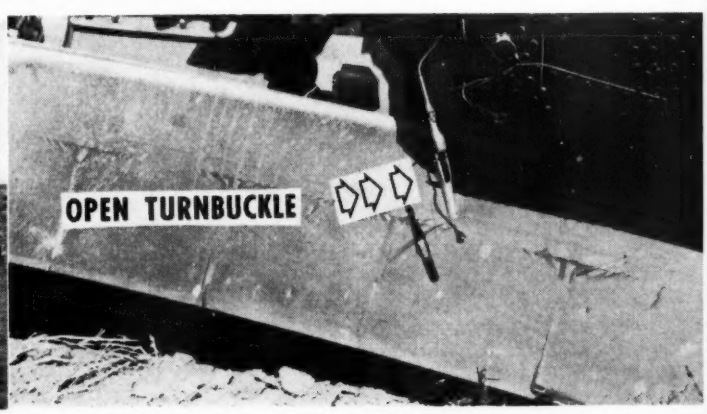
Total aircraft hours at the time of the accident were 2,147. The last periodic inspection had been completed 71 flight hours before the accident. Extensive maintenance had been performed during those 71 hours, although there was no record to show that work had been done on the tail rotor system. It could not be definitely established that any maintenance had been performed on the antitorque control system since the last periodic inspection.

The aircraft had been shipped disassembled to a general depot where it was reassembled and flown to a new station.

Upon arrival at the new sta-

Loss of control caused by unsafetied control cable turnbuckle





tion, numerous discrepancies were noted and the aircraft was turned over to a TAAM company for third and fourth echelon maintenance. The aircraft remained in the TAAM company for approximately two months and was then reassigned to a medical evacuation company. During the time it was in for TAAM maintenance, 38 flight hours were logged. Records were not available for this period and it could not be definitely established that maintenance was performed on the tail rotor. However, it appeared evident that the tail rotor control had been rigged at either the general depot or the TAAM company before it was released to the medical evacuation company. This makes it probable that the quick disconnect was left unsafetied at the time of tail rotor rigging, and neither maintenance personnel nor tech inspector discovered the error. This quick disconnect is located at the extreme aft bulkhead, behind the cargo compartment.

To paraphrase an old saying, *"For the want of a piece of wire, control was lost. For the want of control, the aircraft was lost. For the want of the aircraft, the battle was . . ."*

OPTICAL ILLUSION

The Pilot:

". . . at approximately 0345 hours, I was the pilot for a readiness test that had been called that morning. Lt —— was riding in the observer's seat as the radio operator.

"Because of the urgency of the mission, requiring us to be in the air and establish radio contact within 30 minutes after notification, I made a hasty preflight, started the engine, and attempted to contact the tower.

"We could not contact the tower and I remembered it was not operational at that time of night. I began taxiing out of my parking slot with the assistance of Captain ——, who was outside on the ramp. I did not fill out the forms because not only was I in a hurry, but I felt the flashlight would harm my night vision for the takeoff and flight into darkness. Also, when I returned, it would be daylight and I would have time to complete the forms properly.

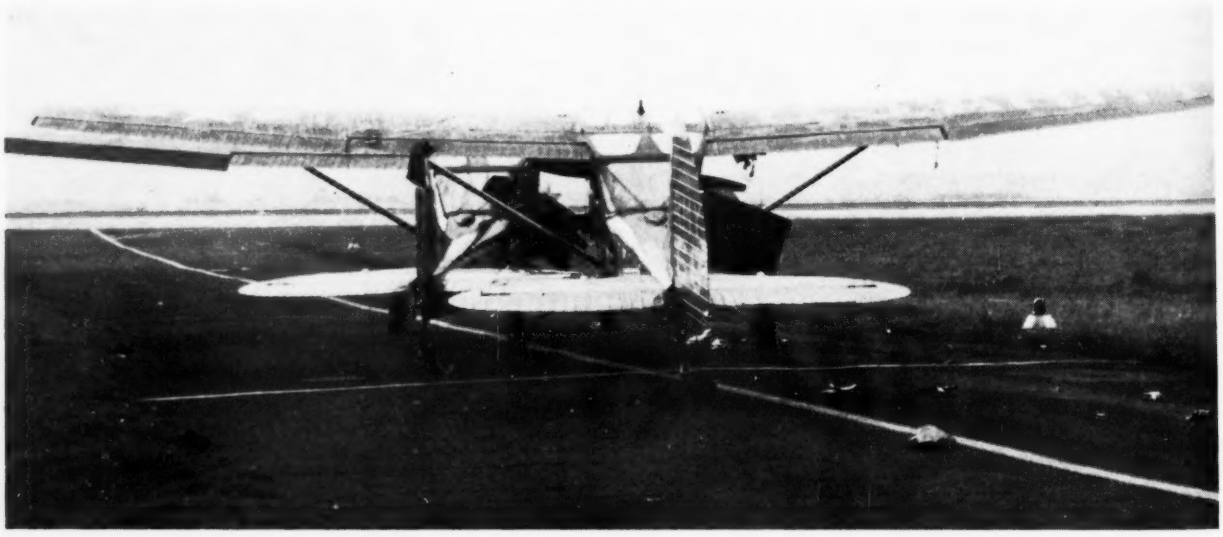
"After leaving the parking area, I looked down the taxi strip for the artillery flight's radio relay plane, which I knew was in the area. As in the past, we were attempting to expedite getting airborne. Although the windshield had been wiped twice, there was moisture on it, and it was extremely dark and difficult to see. However, I thought I saw aircraft lights on the runway. The lights that I had seen could have been a combination of the red night light on the GCA building, the runway lights, and other night lights on the south side of the runway. I assumed the other aircraft was on the runway ready for takeoff, and the taxiway was therefore clear.

"As we were moving toward the runup position, I felt an impact and then saw the other plane with which mine had collided. I shut off the switches and jumped out to see if anybody had been injured in the other aircraft. I then ran back toward operations to notify my section leader."

The Flight Surgeon:

". . . Initially, it appeared as though this accident would be attributed to pilot error with

Pilot error?



little mitigation. However, there were several interesting and revealing factors involved which changed the tenor of this initial pilot error concept significantly.

"The pilot stated to the board that prior to the accident he looked ahead and saw the other aircraft on the active runway and therefore considered it safe to complete his cockpit procedures (radio tuning, etc.) while taxiing to the runup area.

"The other aircraft, however, was not on the active runway at all, but was at the runup area and was just beginning to take the active [runway] at the time of the collision. Knowing the pilot possessed excellent vision, and having no reason to doubt his integrity, the board was led to wonder if the darkness, the presence of moisture on the windshield, and the poorly engineered lighting system could have caused such a distortion of distance relationship. Therefore, that night the board met at the scene of the accident and each member was given the opportunity to experience the same situation previously experienced by the pilot—less the windshield moisture which could not be reproduced.

"Each board member independently saw the aircraft on the active runway when, in fact, it was in the runup area, some 80 feet nearer. Two members actually thought their fellow board members had positioned the test aircraft on the active runway in an attempt to be humorous. Thus the board concluded an optical illusion certainly contributed to, if it didn't actually cause, the accident.

"This illusion was caused by the angle of the aircraft, causing its flashing lights to appear much closer together and the more distant green light, particularly, to seem much further away (approximately 80 feet) than it actually was. This illusion was experienced by the board members without . . . windshield moisture, such as that experienced by the pilot on the morning of the accident.

"Completion of cockpit procedures while taxiing, and taxiing with condensation on the windshield were two safety violations in which the board was keenly interested. A satisfactory explanation cannot be given without a bit of background information: The functions of the aviators providing radio relay support during readiness tests are badly needed ones that have a great deal of attention focused on them until they become operational. Precedent has established a 30-minute maximum time lapse from the time of pilot notification to the time of becoming airborne (operational). Therefore, all deliberate speed is expected of these aviators and in turn they attempt to maintain the examples set by their predecessors and comply with this unwritten 30-minute requirement. Because of this one should not be too severe in his criticism of an aviator who, after initially clearing his windshield of moisture and having it reform, planned on using the defroster to clear it during runup and save some important minutes. This was the same line of thought that resulted in the aviator's assuring himself of a clear taxiway and ascertaining the other aircraft's location, and then devoting part of his attention to cleaning up his cockpit. These two factors certainly contributed to the accident.

"Two other points deserve special mention. One is the obsolete airfield lighting system which is scheduled for replacement in the near future. This includes the hazardous 'security' floodlights which do a fair job of lighting the aircraft parking ramp, and a wonderful job of destroying effective night vision.

"The second point is the 'urgency of the mission.' This point may seem to be trite, and 'passing the buck' to persons or things unknown. In fact it is a very real thing and affects even the most seasoned and experienced personnel. Unfortunately, the new aviator, although professional, may be more prone to regard the urgency of the mission as being of primary importance, and all but the most basic safety factors regarded as being an impediment to expeditiously accomplishing his mission in an acceptable fashion.

"In summary, the pilot error resulted in an accident. This pilot error was not due to negligence—it was primarily due to an optical illusion that was recreated and experienced by the investigation board members. It was contributed to by decreased night vision directly attributed to a poor lighting system. It was possibly contributed to by decreased visual acuity caused by condensation moisture on the windshield. It was contributed to by division of attention between taxi procedures and cockpit preflight procedures. The last two contributions are directly attributed to the pilot's reaction to the urgency of the mission . . ."

THE PRICE OF HAY

A Sioux pilot and his passenger, a newly arrived officer, were on an orientation flight to acquaint the passenger with the area. Flying along a river, the pilot saw two civilians crossing the river from the north bank.

Knowing that civilians were not supposed to be north of the river, the pilot approached the frozen river bank to investigate

What looked like hay . . . was hay!

what appeared to be loads of hay they were carrying. He brought the aircraft to a hover some distance away from the civilians, then moved closer. As he approached the civilians the front of the left main skid caught in the hay or A-frame carried by one of the civilians. This caused the aircraft to go into a nose-low attitude, which the pilot attempted to correct with power and full aft cyclic. Corrective action was not effective and the Sioux crashed into the ice in a 30-40° nose-low attitude. It skidded forward approximately 40 yards and ground to a halt.

The passenger sustained a bruised knee and the pilot escaped uninjured. Damages to the Sioux were estimated at $26,717.02.

Transponder Operating Instructions

IT IS anticipated that a comprehensive article on operation of the AN/APX-44 transponder will be published in the DIGEST in the near future. Meanwhile, the following abbreviated operating instructions are presented for use of the AN/APX-44 transponder for air traffic control *within* the continental United States.

1. ALL switches OFF; function switch on MOD (joint AF/civil) or CIVIL (FAA-ATC) as appropriate. Mode 1 and mode 3 code controls to appropriate code.

2. Set master control in STANDBY position; check pilot light ON.

3. Allow 5 minutes for WARM-UP.

4. Set mode 3 code controls as instructed by appropriate control facility. If none, refer to Jepp for appropriate codes. *After* selecting proper mode and code, set master control to NORMAL, unless directed to set it on LOW.

5. POSITION IDENT

When requested, activate I/P by momentarily hold I/P switch up.

If I/P is not received by the controller, change function selector from CIVIL to MOD, or vice versa. (MOD position should be common to both CIVIL and joint use controllers.)

6. *Emergency*. When an emergency exists, and your transponder is already in operation on a designated code with a *joint use* (AF/civil) facility, depress red button and place master control switch in EMER position.

If in operation with a *civil* (FAA only) facility, it is necessary to select mode 3, code 77 in order to effect an emergency presentation to the controller.

If in doubt, select the emergency position of the master control, *and* mode 3, code 77.

7. Shutdown.

Place all switches OFF.

WIN $125, $75, $50 CASH!

The U.S. Army Aviation Digest Announces Its 3d Annual Writing Awards Contest July 1, 1963 - June 30, 1964

The purpose of the contest is to encourage those interested in the Army Aviation Program to share their ideas or experiences on any subject pertinent to the mission of the magazine. Contest is open to everyone.

CONTEST RULES

Three cash awards will be given annually to authors whose articles are considered the best contributions of the fiscal year. First prize will be $125.00; second prize $75.00; and third prize $50.00.

1. Monthly winners will receive an appropriate certificate of award. Annual award winners will be selected from the 12 monthly award winners.

2. No member of the U. S. ARMY AVIATION DIGEST staff or the Education and Literature Division of the U. S. Army Board for Aviation Accident Research may participate in the contest. Regular departments of the magazine are also excluded.

3. Article topics must be within the scope of the mission of the U. S. ARMY AVIATION DIGEST: "to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data."

4. Articles must not have been submitted to other publications or have been previously published.

5. Articles should be approximately 1,500-2,000 words in length. (This will be approximately 5-6 double-spaced typewritten pages. Entries will not be judged on typing or neatness, however.)

6. Only articles selected for publication will be judged.

7. Articles selected for publication will be retyped in the original wording and be submitted to the judges in unedited form, without bylines.

8. Monthly and annual winners will be chosen based on:

Accuracy	**Reader appeal**
Completeness	**Timeliness**
Originality	**Substance**
Readability	**Overall merit**

* * *

All entries should be mailed to: Editor-in-Chief, U. S. ARMY AVIATION DIGEST, U. S. Army Aviation School, Fort Rucker, Ala.

Appropriate pictures, diagrams, charts, etc., necessary to illustrate articles should be backed with protective cardboard for enclosure with the manuscript. Photographs preferably should be 8 x 10 black and white glossy prints. Illustrations will be returned if requested. Articles will not be judged on the artwork or photos submitted.

UNITED STATES ARMY
AVIATION DIGEST

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PINPOINT DISTRIBUTION ANNOUNCED FOR DIGEST

Have your copies of the DIGEST been getting "lost on post"? Well, now YOU can correct the situation and receive the quantities you need, quicker.

Effective 15 May the magazine will be distributed within the Active Army according to the pinpoint distribution method outlined in Section 3, Chapter 3 of AR 310-1, dated 20 March 1961. This new pinpoint distribution method means that you get the magazine directly from the printer.

First, though, your unit has to submit immediately a DA Form 12-4 to the AG Publications Center. On it you request the number of copies of the DIGEST you want your unit to receive regularly and without interruption.

If you command a unit of company or battery size or smaller, send the Form 12-4 to your next higher command for approval and forwarding to the CO, AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md.

All other units, organizations, or headquarters submit Form 12-4 directly to the Publications Center. If subsequently any unit wishes to change the number of magazines received, submit a revised 12-4 directly to the Baltimore AG Publications Center.

Read all the details on this new distribution system in DA Circular 310-57, dated 14 March 1963. "Pinpoint Distribution of Department of the Army and Other Administrative Publications Except Regulations and Circulars."

Organizations that have already established "pinpoint" distribution accounts at the Baltimore Publications Center will include their assigned account numbers in the appropriate block on DA Form 12-4.

WHO WHEN WHERE WHAT WHY HOW

WHO:	All units.
WHEN:	Pronto.
WHERE:	Worldwide.
WHAT:	Read DA Circular 310-57, dated 14 March 1963, apd Section 3, Chapter 2, AR 310-1, dated 20 March 1961.
WHY:	To continue getting all the DIGESTs you need.
HOW:	Fill out DA Form 12-4 and send immediately to: CO, AG Publications Center 2800 Eastern Boulevard Baltimore, Md.